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Orinda Intellectual Properties USA
Holding Group, Inc.

UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA

OAKLAND DIVISION

ORINDA INTELLECTUAL PROPERTIES USA HOLDING GROUP, INC.,

Plaintiff,

v.

ASUSTEK COMPUTER INC., ASUS COMPUTER INTERNATIONAL, INC., AUDIO PARTNERSHIP PLC, CAMBRIDGE AUDIO LTD., AUDIOVOX CORPORATION, AUDIOVOX ELECTRONICS CORPORATION, BEST BUY STORES L.P., BESTBUY.COM LLC, DELL INC., D&M HOLDINGS INC., D&M HOLDINGS US INC., DENON ELECTRONICS (USA), LLC, MARANTZ AMERICA, INC., FUNAI CORPORATION, INC., FUNAI ELECTRIC CO., LTD., HARMAN INTERNATIONAL INDUSTRIES, INC., HEWLETT-PACKARD COMPANY, VICTOR COMPANY OF JAPAN, LTD., JVC AMERICAS CORPORATION, KONINKLIJKE PHILIPS ELECTRONICS N.V., PHILIPS

Case No. C 11-02010 SBA

FIRST AMENDED COMPLAINT FOR PATENT INFRINGEMENT AND DEMAND FOR JURY TRIAL

ELECTRONICS NORTH AMERICA CORPORATION, LENOVO (UNITED STATES) INC., LG ELECTRONICS INC., LG ELECTRONICS U.S.A., INC., LITE-ON IT CORPORATION, LITE-ON IT AMERICAS, INC., MICRO-STAR INTERNATIONAL COMPANY, LTD., MSI COMPUTER CORPORATION, NAD ELECTRONICS INTERNATIONAL, NAD ELECTRONICS OF AMERICA, ONKYO CORPORATION, ONKYO USA CORPORATION, OPPO DIGITAL, INC., PANASONIC CORPORATION, PANASONIC CORPORATION OF NORTH AMERICA, PIONEER CORPORATION, PIONEER ELECTRONICS (USA) INC., SAMSUNG ELECTRONICS AMERICA, INC., SAMSUNG ELECTRONICS CO., LTD., SHARP CORPORATION, SHARP ELECTRONICS CORPORATION, TOSHIBA CORPORATION, TOSHIBA AMERICA INFORMATION SYSTEMS, INC., VIEWSONIC CORPORATION, VIEWSONIC INTERNATIONAL CORPORATION, VIZIO, INC., YAMAHA CORPORATION, YAMAHA CORPORATION OF AMERICA, YAMAHA ELECTRONICS CORPORATION, USA,

Defendants.

Plaintiff Orinda Intellectual Properties USA Holding Group, Inc. ("Orinda") hereby brings this action for patent infringement against ASUSTek Computer Inc., ASUS Computer International, Inc., Audio Partnership Plc, Cambridge Audio Ltd., Audiovox Corporation, Audiovox Electronics Corporation, Best Buy Stores L.P., BestBuy.com LLC, Dell Inc., D&M Holdings Inc., D&M Holdings US Inc., Denon Electronics (USA) LLC, Marantz America, Inc., Funai Corporation, Inc., Funai Electric Co., Ltd., Harman International Industries, Inc., Hewlett-Packard Company, Victor Company Of Japan, Ltd., JVC Americas Corporation, Koninklijke Philips Electronics N.V., Philips Electronics North America Corporation, Lenovo (United States) Inc., LG Electronics Inc., LG Electronics U.S.A. Inc., Lite-On IT Corporation, Lite-On IT Americas, Inc., Micro-Star International Co., Ltd., MSI Computer Corporation, NAD Electronics International, NAD Electronics Of America, Onkyo Corporation, Onkyo USA Corporation, OPPO Digital, Inc., Panasonic Corporation, Panasonic Corporation Of North America, Pioneer Corporation, Pioneer Electronics (USA) Inc., Samsung Electronics America, Inc., Samsung Electronics Co., Ltd., Sharp Corporation, Sharp Electronics Corporation, Toshiba Corporation, Toshiba America Information Systems, Inc., ViewSonic Corporation, ViewSonic International Corporation, Vizio, Inc., Yamaha Corporation, Yamaha Corporation Of America, and Yamaha Electronics Corporation, USA (collectively, "Defendants"), and alleges as follows:

NATURE OF THE ACTION AND PARTIES

1. This is an action for patent infringement arising under the patent laws of the United States, Title 35 of the United States Code.

2. Plaintiff Orinda is a corporation organized under the laws of California with its principal place of business at 357 Castro Street, Suite 5, Mountain View, California 94041.

3. On information and belief, defendant ASUSTek Computer Inc. ("ASUS") is a corporation organized under the laws of Taiwan with its principal place of business at No.15, Li-Te Rd., Peitou District, Taipei 112, Taiwan, R.O.C.

4. On information and belief, defendant ASUS Computer International, Inc. ("ASUS International") is a corporation organized under the laws of California with its principal place of business at 800 Corporate Way, Fremont, California 94539.

5. On information and belief, defendant Audio Partnership Plc ("Audio Partnership") is a corporation organized under the laws of the United Kingdom with its principal place of business at Gallery Court, Hankey Place, London SE1 4BB, United Kingdom.

6. On information and belief, defendant Cambridge Audio Ltd. ("Cambridge Audio") is a limited company organized under the laws of the United Kingdom with its principal place of business at Gallery Court, Hankey Place, London SE1 4BB, United Kingdom.

7. Audiovox Corporation ("Audiovox") is a corporation organized under the laws of Delaware with its principal place of business at 180 Marcus Boulevard, Hauppauge, New York 11788.

8. On information and belief, defendant Audiovox Electronics Corporation ("Audiovox Electronics") is a corporation organized under the laws of Delaware with its principal place of business at 180 Marcus Boulevard, Hauppauge, New York 11788.

9. On information and belief, defendant Best Buy Stores L.P. ("Best Buy") is a corporation organized under the laws of Virginia with its principal place of business at 7601 Penn Avenue South, Richfield, Minnesota 55423.

10. On information and belief, defendant BestBuy.com LLC ("BestBuy.com") is a limited liability company organized under the laws of Virginia with its principal place of business at 7601 Penn Avenue South, Richfield, Minnesota 55423.

11. On information and belief, defendant Dell Inc. ("Dell") is a corporation organized under the laws of Delaware with its principal place of business at One Dell Way, Round Rock, Texas 78682.

12. On information and belief, defendant D&M Holdings Inc. ("D&M") is a corporation organized under the laws of Japan with its principal place of business at D&M Building 2-1, Nisshin-cho, Kawasaki-ku, Kawasaki-shi, Kanagawa, 210-8569 Japan.

13. On information and belief, defendant D&M Holdings US Inc. ("D&M US") is a corporation organized under the laws of Delaware with its principal place of business at 100 Corporate Drive, Mahwah, New Jersey 07430-2041.

14. On information and belief, defendant Denon Electronics (USA) LLC ("Denon") is

a corporation organized under the laws of Delaware with its principal place of business at 100 Corporate Drive, Mahwah, New Jersey 07430-2041.

15. On information and belief, defendant Marantz America, Inc. ("Marantz") is a corporation organized under the laws of Delaware with its principal place of business at 100 Corporate Drive, Mahwah, New Jersey 07430-2041.

16. On information and belief, defendant Funai Corporation, Inc. ("Funai") is a corporation organized under the laws of New Jersey with its principal place of business at 201 Route 17 North, Suite 903, Rutherford, New Jersey 07070.

17. On information and belief, defendant Funai Electric Co., Ltd. ("Funai Ltd.") is a limited company organized under the laws of Japan with its principal place of business at 7-7-1 Nakagaito, Daito city, Osaka 574-0013.

18. On information and belief, defendant Harman International Industries, Inc. ("Harman Kardon") is a corporation organized under the laws of Delaware with its principal place of business at 400 Atlantic Street, 15th Floor, Stamford, Connecticut 06901.

19. On information and belief, defendant Hewlett-Packard Company ("HP") is a corporation organized under the laws of California with its principal place of business at 3000 Hanover Street, Palo Alto, California 94304-1185.

20. On information and belief, defendant Victor Company Of Japan, Ltd. ("JVC") is a limited company organized under the laws of Japan with its principal place of business at 3-12, Moriyacho, Kanagawa-ku, Yokohama-shi, Kanagawa, 221-8528, Japan.

21. On information and belief, defendant JVC Americas Corporation ("JVC America") is a corporation organized under the laws of Delaware with its principal place of business at 1700 Valley Rd., Wayne, New Jersey 07470.

22. On information and belief, defendant Koninklijke Philips Electronics N.V. ("Philips") is a company organized under the laws of the Netherlands with its principal place of business at Amstelplein 2, Breitner Center PO Box 77900, Amsterdam, 1070 MX, Netherlands.

23. On information and belief, defendant Philips Electronics North America Corporation ("Philips NA") is a corporation organized under the laws of Delaware with its

principal place of business at 3000 Minuteman Rd., Building One, Andover, Massachusetts, 01810.

24. On information and belief, defendant Lenovo (United States) Inc. ("Lenovo") is a corporation organized under the laws of Delaware with its principal place of business at 1009 Think Place, Morrisville, North Carolina 27560.

25. On information and belief, defendant LG Electronics Inc. ("LG") is a corporation organized under the laws of South Korea with its principal place of business at LG Twin Towers 20, Yoido-dong, Youngdungpo-gu Seoul 150-721, South Korea.

26. On information and belief, defendant LG Electronics U.S.A. Inc. ("LG USA") is a corporation organized under the laws of New Jersey with its principal place of business at 1000 Sylvan Avenue, Englewood Cliffs, New Jersey 07632.

27. On information and belief, defendant Lite-On IT Corporation ("Lite-On") is a corporation organized under the laws of Taiwan with its principal place of business at 12F, 392, Ruey Kuang Road, Neihu, Taipei 114, Taiwan, R.O.C.

28. On information and belief, defendant Lite-On IT Americas, Inc. ("Lite-On Americas") is a corporation organized and existing under the laws of Delaware with its principal place of business at 42000 Christy Street Fremont, California 94538.

29. On information and belief, defendant Micro-Star International Company, Ltd. ("Microstar") is a corporation organized under the laws of Taiwan with its principal place of business at No. 69, Lide St., Zhonghe Dist., New Taipei City 235, Taiwan, R.O.C.

30. On information and belief, defendant MSI Computer Corporation ("MSI") is a corporation organized under the laws of California with its principal place of business at 901 Canada Court, City of Industry, California 91748.

31. On information and belief, defendant NAD Electronics International ("NAD") is a corporation organized under the laws of Canada with its principal place of business at 633 Granite Court Pickering, Ontario L1W 3K1 Canada.

32. On information and belief, defendant NAD Electronics Of America ("NAD America") is a corporation organized under the laws of Delaware with its principal place of

business at 6 Merchant Street, Sharon, Massachusetts 02067.

33. On information and belief, defendant Onkyo Corporation ("Onkyo") is a corporation organized under the laws of Japan with its principal place of business at 2-1, Nisshin-cho, Neyagawa-shi, Osaka 572-8540, Japan.

34. On information and belief, defendant Onkyo USA Corporation ("Onkyo USA") is a corporation organized under the laws of New Jersey with its principal place of business at 18 Park Way, Upper Saddle River, New Jersey 07458.

35. On information and belief, defendant OPPO Digital, Inc. ("OPPO") is a corporation organized under the laws of California with its principal place of business at 2629 Terminal Blvd., Suite B, Mountain View, California 94043.

36. On information and belief, defendant Panasonic Corporation ("Panasonic") is a corporation organized under the laws of Japan with its principal place of business at 1006, Oaza Kadoma, Kadoma-shi, Osaka 571-8501, Japan.

37. On information and belief, defendant Panasonic Corporation of North America ("Panasonic NA") is a corporation organized under the laws of New Jersey with its principal place of business at 1 Panasonic Way, Secaucus, New Jersey 07094.

38. On information and belief, defendant Pioneer Corporation ("Pioneer") is a corporation organized under the laws of Japan with its principal place of business at 1-1 Shin-ogura, Saiwai-ku, Kawasaki-shi, Kanagawa 212-0031, Japan.

39. On information and belief, defendant Pioneer Electronics (USA) Inc. ("Pioneer USA") is a corporation organized under the laws of California with its principal place of business at 2265 E. 220th St., Long Beach, California 90810.

40. On information and belief, defendant Samsung Electronics America, Inc. ("SEA") is a corporation organized under the laws of New Jersey with its principal place of business at 85 Challenger Road, Ridgefield Park, New Jersey 07660.

41. On information and belief, defendant Samsung Electronics Co., Ltd. ("SEC") is a limited company corporation organized under the laws of South Korea with its principal place of business at 1320-10, Seocho 2-dong, Seocho-gu, Seoul 137-857, South Korea.

42. On information and belief, defendant Sharp Corporation ("Sharp") is a corporation organized under the laws of Japan with its principal place of business at 22-22 Nagaike-cho, Abeno-ku, Osaka 545-8522, Japan.

43. On information and belief, defendant Sharp Electronics Corporation ("Sharp Electronics") is a corporation organized under the laws of New Jersey with its principal place of business at Sharp Plaza, Mahwah, New Jersey 07495-1163.

44. On information and belief, defendant Toshiba Corporation ("Toshiba") is a corporation organized under the laws of Japan with its principal place of business at 1-1, Shibaura 1-chome, Minato-ku, Tokyo 105-8001, Japan.

45. On information and belief, defendant Toshiba America Information Systems, Inc. ("TAIS") is a corporation organized under the laws of California with its principal place of business at 9740 Irvine Boulevard, Irvine, California, 92718-1697.

46. On information and belief, defendant ViewSonic Corporation ("ViewSonic") is a corporation organized under the laws of Delaware with its principal place of business at 381 Brea Canyon Road, Walnut, California 91789.

47. On information and belief, defendant ViewSonic International Corporation ("ViewSonic International") is a corporation organized under the laws of Taiwan with its principal place of business at 9F, No. 192, Lien Chen Road, Chung Ho, 235 Taipei, Taiwan, R.O.C.

48. On information and belief, defendant Vizio, Inc. ("Vizio") is a corporation organized under the laws of California with its principal place of business at 39 Tesla, Irvine, California 92618.

49. On information and belief, defendant Yamaha Corporation ("Yamaha") is a corporation organized under the laws of Japan with its principal place of business at 10-1, Nakazawa-cho, Naka-ku, Hamamatsu, Shizuoka 430-8650, Japan.

50. On information and belief, defendant Yamaha Corporation of America ("Yamaha America") is a corporation organized under the laws of California with its principal place of business at 6000 Orangethorpe Avenue, Buena Park, California 90620.

51. On information and belief, defendant Yamaha Electronics Corporation, USA ("Yamaha USA") is a corporation organized under the laws of California with its principal place of business at 6000 Orangethorpe Avenue, Buena Park, California 90620.

JURISDICTION

52. This court has subject matter jurisdiction over this action pursuant to 35 U.S.C. § 271 et seq., 28 U.S.C. §§ 1331 and 1338(a). Defendants are subject to personal jurisdiction in this district because each Defendant has conducted and does conduct business within the State of California. Each Defendant, directly or through intermediaries (including distributors, retailers, and others), ships, distributes, offers for sale, sells, and advertises (including the provision of an interactive web page) its products in the United States, the State of California, and the Northern District of California. Upon information and belief, each Defendant has purposefully and voluntarily placed one or more of its infringing products, as described below, into the stream of commerce with the expectation that they will be purchased by consumers in the Northern District of California. Upon information and belief, these infringing products have been and continue to be purchased by consumers in the Northern District of California. Each Defendant has committed the tort of patent infringement within the State of California and, more particularly, within the Northern District of California.

VENUE

53. Venue is proper in this district pursuant to 28 U.S.C. §§ 1391(b), 1391(c) and 1391 (d) and 28 U.S.C. § 1400(b). Defendants reside in this district because they are subject to personal jurisdiction in this district.

INTRADISTRICT ASSIGNMENT

54. Because this is an Intellectual Property Action as specified in Civil L.R. 3-2(c), it is to be assigned on a district-wide basis.

FIRST CLAIM FOR RELIEF

(Infringement of United States Patent No. 5,438,560)

55. Orinda holds all right, title and interest in United States Patent No. 5,438,560 ("the '560 patent"). The '560 patent is entitled "Apparatus and Method for Recording/Reproducing

Optical Information and Optical Disk-Shaped Recording Medium." The application resulting in the '560 patent was filed on October 21, 1993, and the United States Patent and Trademark Office duly and legally issued the '560 patent on August 1, 1995. A copy of the '560 patent is attached hereto as Exhibit A.

56. The '560 patent generally claims methods for recording and reproducing optical information using optical discs, such as Blu-ray discs. Products that include drives that play or record Blu-ray discs practice one or more claims of the '560 patent when those products are used.

57. ASUS and ASUS International make or have made, use, offer to sell, sell, distribute, supply, provide and/or import into the United States products that include Blu-ray drives, including but not limited to laptop computer models G73SW and G73JW ("the ASUS Accused Products"). ASUS and ASUS International directly infringe the '560 patent by, among other activities, operating the Blu-ray drive in the ASUS Accused Products. ASUS and ASUS International are also indirectly liable for the direct infringement of the '560 patent by others. Consumers and other users of the Blu-ray drive in the ASUS Accused Products directly infringe the '560 patent when they operate the Blu-ray drive in the ASUS Accused Products for personal use or otherwise. ASUS and ASUS International induce such end-users' direct infringement because ASUS and ASUS International, with knowledge of the '560 patent, knowingly and intentionally encourage the end-users to operate the Blu-ray drives in the ASUS Accused Products by, among other means, providing instructions for the use of the ASUS Accused Products, providing technical support to such end users, and advertising the ASUS Accused Products for use in an infringing manner. ASUS and ASUS International contribute to end-users' infringement of the '560 patent by offering for sale, selling, importing into the United States, distributing, supplying, and/or otherwise providing the ASUS Accused Products for use by end-users with knowledge that the Blu-ray drives in the ASUS Accused Products are designed for use in a manner that practices the inventions claimed in the '560 patent, and that the Blu-ray drives in the ASUS Accused Products do not have substantial non-infringing uses.

58. Defendant Audio Partnership and Cambridge Audio make or have made, use, offer to sell, sell, distribute, supply, provide and/or import into the United States products that include

Blu-ray drives, including but not limited to Blu-ray players sold under the Cambridge Audio brand, such as models Azur 751BD and Azur 650BD sold (collectively, "the Cambridge Audio Accused Products"). Audio Partnership and Cambridge Audio directly infringe the '560 patent by, among other activities, operating the Blu-ray drive in the Cambridge Audio Accused Products. Audio Partnership and Cambridge Audio are also indirectly liable for the direct infringement of the '560 patent by others. Consumers and other users of the Blu-ray drive in the Cambridge Audio Accused Products directly infringe the '560 patent when they operate the Blu-ray drive in the Cambridge Audio Accused Products for personal use or otherwise. Audio Partnership and Cambridge Audio induce such end-users' direct infringement because Audio Partnership and Cambridge Audio, with knowledge of the '560 patent, knowingly and intentionally encourage the end-users to operate the Blu-ray drives in the Cambridge Audio Accused Products by, among other means, providing instructions for the use of the Cambridge Audio Accused Products, providing technical support to such end users, and advertising the Cambridge Audio Accused Products for use in an infringing manner. Audio Partnership and Cambridge Audio contribute to end-users' infringement of the '560 patent by offering for sale, selling, importing into the United States, distributing, supplying, and/or otherwise providing the Cambridge Accused Products for use by end-users with knowledge that the Blu-ray drives in the Cambridge Audio Accused Products are designed for use in a manner that practices the inventions claimed in the '560 patent, and that the Blu-ray drives in the Cambridge Audio Accused Products do not have substantial non-infringing uses.

59. Defendants Audiovox and Audiovox Electronics make or have made, use, offer to sell, sell, distribute, supply, provide and/or import into the United States products that include Blu-ray drives, including but not limited to Blu-ray players sold under the RCA® brand, such as home theater model RTB1023 and Blu-ray player models BRC11082 and BRC3108 (collectively, "the Audiovox Accused Products"). Audiovox and Audiovox Electronics directly infringe the '560 patent by, among other activities, operating the Blu-ray drive in the Audiovox Accused Products. Audiovox and Audiovox Electronics are also indirectly liable for the direct infringement of the '560 patent by others. Consumers and other users of the Blu-ray drive in the

Audiovox Accused Products directly infringe the '560 patent when they operate the Blu-ray drive in the Audiovox Accused Products for personal use or otherwise. Audiovox and Audiovox Electronics induce such end-users' direct infringement because Audiovox and Audiovox Electronics, with knowledge of the '560 patent, knowingly and intentionally encourage end-users to operate the Blu-ray drives in the Audiovox Accused Products by, among other means, providing instructions for the use of the Audiovox Accused Products, providing technical support to such end users, and advertising the Audiovox Accused Products for use in an infringing manner. Audiovox and Audiovox Electronics contribute to end-users' infringement of the '560 patent by offering for sale, selling, importing into the United States, distributing, supplying, and/or otherwise providing the Audiovox Accused Products for use by end-users with knowledge that the Blu-ray drives in the Audiovox Accused Products are designed for use in a manner that practices the inventions claimed in the '560 patent, and that the Blu-ray drives in the Audiovox Accused Products do not have substantial non-infringing uses.

60. Defendants Best Buy and BestBuy.com make or have made, use, offer to sell, sell, distribute, supply, provide and/or import into the United States products that include Blu-ray drives, including but not limited to Blu-ray players sold under the Insignia® brand, such as models NS-WBRDVD2 and NS-BRDVD4 (collectively, "the Best Buy Accused Products"). Best Buy and BestBuy.com directly infringe the '560 patent by, among other activities, operating the Blu-ray drive in the Best Buy Accused Products. Best Buy and BestBuy.com are also indirectly liable for the direct infringement of the '560 patent by others. Consumers and other users of the Blu-ray drive in the Best Buy Accused Products directly infringe the '560 patent when they operate the Blu-ray drive in the Best Buy Accused Products for personal use or otherwise. Best Buy and BestBuy.com induce such end-users' direct infringement because Best Buy and BestBuy.com, with knowledge of the '560 patent, knowingly and intentionally encourage end-users to operate the Blu-ray drives in the Best Buy Accused Products by, among other means, providing instructions for the use of the Best Buy Accused Products, providing technical support to such end users, and advertising the Best Buy Accused Products for use in an infringing manner. Best Buy and BestBuy.com contribute to end-users' infringement of the '560

patent by offering for sale, selling, importing into the United States, distributing, supplying, and/or otherwise providing the Best Buy Accused Products for use by end-users with knowledge that the Blu-ray drives in the Best Buy Accused Products are designed for use in a manner that practices the inventions claimed in the '560 patent, and that the Blu-ray drives in the Best Buy Accused Products do not have substantial non-infringing uses.

61. Defendant Dell makes or has made, uses, offers to sell, sells, distributes, supplies, provides and/or imports into the United States products that include Blu-ray drives, including but not limited to laptop computer models Inspiron 14R, Inspiron 15R, Inspiron 17R, XPS 15 and XPS 17 (collectively, "the Dell Accused Products"). Dell directly infringes the '560 patent by, among other activities, operating the Blu-ray drive in the Dell Accused Products. Dell is also indirectly liable for the direct infringement of the '560 patent by others. Consumers and other users of the Blu-ray drive in the Dell Accused Products directly infringe the '560 patent when they operate the Blu-ray drive in the Dell Accused Products for personal use or otherwise. Dell induces such end-users' direct infringement because Dell, with knowledge of the '560 patent, knowingly and intentionally encourages end-users to operate the Blu-ray drives in the Dell Accused Products by, among other means, providing instructions for use of the Dell Accused Products, providing technical support to such end users, and advertising the Dell Accused Products for use in an infringing manner. Dell contributes to end-users' infringement of the '560 patent by offering for sale, selling, importing into the United States, distributing, supplying, and/or otherwise providing the Dell Accused Products for use by end-users with knowledge that the Blu-ray drives in the Dell Accused Products are designed for use in a manner that practices the inventions claimed in the '560 patent, and that the Blu-ray drives in the Dell Accused Products do not have substantial non-infringing uses.

62. Defendants D&M, D&M US, Denon, and Marantz make or have made, use, offer to sell, sell, distribute, supply, provide and/or import into the United States products that include Blu-ray drives, including but not limited to Blu-ray player models DBP-1610, DBP-1611UD, DBP-2010CI, DBP-2012UDCI, DBP-4010UDCI, DVD-A1UDCI, and S-5BD, sold under the Denon brand, and UD5005, UD7006, UD8004, and UD9004, sold under the Marantz brand

(collectively, "the D&M Accused Products"). Defendants D&M, D&M US, Denon, and Marantz directly infringe the '560 patent by, among other activities, operating the Blu-ray drive in the D&M Accused Products. Defendants D&M, D&M US, Denon, and Marantz are also indirectly liable for the direct infringement of the '560 patent by others. Consumers and other users of the Blu-ray drive in the D&M Accused Products directly infringe the '560 patent when they operate the Blu-ray drive in the D&M Accused Products for personal use or otherwise. Defendants D&M, D&M US, Denon, and Marantz induce such end-users' direct infringement because Defendants D&M, D&M US, Denon, and Marantz, with knowledge of the '560 patent, knowingly and intentionally encourage end-users to operate the Blu-ray drives in the D&M Accused Products by, among other means, providing instructions for use of the D&M Accused Products, providing technical support to such end users, and advertising the D&M Accused Products for use in an infringing manner. Defendants D&M, D&M US, Denon, and Marantz contribute to end-users' infringement of the '560 patent by offering for sale, selling, importing into the United States, distributing, supplying, and/or otherwise providing the D&M Accused Products for use by end-users with knowledge that the Blu-ray drives in the D&M Accused Products are designed for use in a manner that practices the inventions claimed in the '560 patent, and that the Blu-ray drives in the D&M Accused Products do not have substantial non-infringing uses.

63. Defendants Funai and Funai Ltd. make or have made, use, offer to sell, sell, distribute, supply, provide and/or import into the United States products that include Blu-ray drives, including but not limited to Blu-ray home theater system models MRD410B, Blu-ray disc player models NB500MG1F and NB530MGX, and Blu-ray combination television models 42MD459B, which are sold under the Magnavox brand, and Blu-ray combination television models LD427SSX and Blu-ray disc player models NB530SLX and NB620SL1, which are sold under the Sylvania brand (collectively, "the Funai Accused Products"). Funai and Funai Ltd. directly infringe the '560 patent by, among other activities, operating the Blu-ray drive in the Funai Accused Products. Funai and Funai Ltd. are also indirectly liable for the direct infringement of the '560 patent by others. Consumers and other users of the Blu-ray drive in the

Funai Accused Products directly infringe the '560 patent when they operate the Blu-ray drive in the Funai Accused Products for personal use or otherwise. Funai and Funai Ltd. induce such end-users' direct infringement because Funai and Funai Ltd., with knowledge of the '560 patent, knowingly and intentionally encourage end-users to operate the Blu-ray drives in the Funai Accused Products by, among other means, providing instructions for use of the Funai Accused Products, providing technical support to such end users, and advertising the Funai Accused Products for use in an infringing manner. Funai and Funai Ltd. contribute to end-users' infringement of the '560 patent by offering for sale, selling, importing into the United States, distributing, supplying, and/or otherwise providing the Funai Accused Products for use by end-users with knowledge that the Blu-ray drives in the Funai Accused Products are designed for use in a manner that practices the inventions claimed in the '560 patent, and that the Blu-ray drives in the Funai Accused Products do not have substantial non-infringing uses.

64. Defendant Harman Kardon makes, uses, offers to sell, sells, distributes, supplies, provides, and/or imports into the United States products that include Blu-ray drives, including but not limited to Blu-ray player models BDS 2 SO/120, BDS 5 SO/120, which are sold under the "Harman/Kardon" brand, and BD 30, which is sold under the "Lexicon" brand (collectively, "the Harman Kardon Accused Products"). Harman Kardon directly infringes the '560 patent by, among other activities, operating the Blu-ray drive in the Harman Kardon Accused Products. Harman Kardon is also indirectly liable for the direct infringement of the '560 patent by others. Consumers and other users of the Blu-ray drive in the Harman Kardon Accused Products directly infringe the '560 patent when they operate the Blu-ray drive in the Harman Kardon Accused Products for personal use or otherwise. Harman Kardon induces such end-users' direct infringement because Harman Kardon, with knowledge of the '560 patent, knowingly and intentionally encourages end-users to operate the Blu-ray drives in the Harman Kardon Accused Products by, among other means, providing instructions for use of the Harman Kardon Accused Products, providing technical support to such end users, and advertising the Harman Kardon Accused Products for use in an infringing manner. Harman Kardon contributes to end-users' infringement of the '560 patent by offering for sale, selling, importing into the United States,

distributing, supplying, and/or otherwise providing the Harman Kardon Accused Products for use by end-users with knowledge that the Blu-ray drives in the Harman Kardon Accused Products are designed for use in a manner that practices the inventions claimed in the '560 patent, and that the Blu-ray drives in the Harman Kardon Accused Products do not have substantial non-infringing uses.

65. Defendant HP makes, uses, offers to sell, sells, distributes, supplies, provides, and/or imports into the United States products that include Blu-ray drives, including but not limited to computer models HP Pavilion dv7t Select Edition, HP Pavilion dv6t Select Edition, HP Pavilion Elite HPE-390t, HP Pavilion Elite HPE-380t, HP Pavilion Elite HPE-360z, HP Pavilion Elite HPE-350t PC, HP Pavilion Elite HPE-310t, HP Pavilion Slimline s5580t, HP Pavilion p6580t, HP Pavilion Elite HPE-300z, HP Pavilion Slimline s5570t, HP Pavilion p6570t, HP Pavilion Slimline s5550z, HP Pavilion Slimline s5510t, HP Pavilion p6510t, HP Pavilion Slimline s5500z, HP Pavilion p6500z, and HP Pavilion p6550z, and optical disc drive model number HP bd240i Internal SATA Blu-ray Combo Drive (collectively, "the HP Accused Products"). HP directly infringes the '560 patent by, among other activities, operating the Blu-ray drive in the HP Accused Products. HP is also indirectly liable for the direct infringement of the '560 patent by others. Consumers and other users of the Blu-ray drive in the HP Accused Products directly infringe the '560 patent when they operate the Blu-ray drive in the HP Accused Products for personal use or otherwise. HP induces such end-users' direct infringement because HP, with knowledge of the '560 patent, knowingly and intentionally encourages end-users to operate the Blu-ray drives in the HP Accused Products by, among other means, providing instructions for use of the HP Accused Products, providing technical support to such end users, and advertising the HP Accused Products for use in an infringing manner. HP contributes to end-users' infringement of the '560 patent by offering for sale, selling, importing into the United States, distributing, supplying, and/or otherwise providing the HP Accused Products for use by end-users with knowledge that the Blu-ray drives in the HP Accused Products are designed for use in a manner that practices the inventions claimed in the '560 patent, and that the Blu-ray drives in the HP Accused Products do not have substantial non-infringing uses.

66. Defendants JVC and JVC Americas make or have made, use, offer to sell, sell, distribute, supply, provide and/or import into the United States products that include Blu-ray drives, including but not limited to Blu-ray player models XV-BP11 and XV-BP1 (collectively, "the JVC Accused Products"). JVC and JVC Americas directly infringe the '560 patent by, among other activities, operating the Blu-ray drive in the JVC Accused Products. JVC and JVC Americas are also indirectly liable for the direct infringement of the '560 patent by others. Consumers and other users of the Blu-ray drive in the JVC Accused Products directly infringe the '560 patent when they operate the Blu-ray drive in the JVC Accused Products for personal use or otherwise. JVC and JVC Americas induce such end-users' direct infringement because JVC and JVC Americas, with knowledge of the '560 patent, knowingly and intentionally encourage end-users to operate the Blu-ray drives in the JVC Accused Products by, among other means, providing instructions for use of the JVC Accused Products, providing technical support to such end users, and advertising the JVC Accused Products for use in an infringing manner. JVC and JVC Americas contribute to end-users' infringement of the '560 patent by offering for sale, selling, importing into the United States, distributing, supplying, and/or otherwise providing the JVC Accused Products for use by end-users with knowledge that the Blu-ray drives in the JVC Accused Products are designed for use in a manner that practices the inventions claimed in the '560 patent, and that the Blu-ray drives in the JVC Accused Products do not have substantial non-infringing uses.

67. Defendant Lenovo makes or has made, uses, offers to sell, sells, distributes, supplies, provides and/or imports into the United States products that include Blu-ray drives, including but not limited to optical disc drive models 45K1675 and 43R9150, and computer models K300 and K320 (collectively, "the Lenovo Accused Products"). Lenovo directly infringes the '560 patent by, among other activities, operating the Blu-ray drive in the Lenovo Accused Products. Lenovo is also indirectly liable for the direct infringement of the '560 patent by others. Consumers and other users of the Blu-ray drive in the Lenovo Accused Products directly infringe the '560 patent when they operate the Blu-ray drive in the Lenovo Accused Products for personal use or otherwise. Lenovo induces such end-users' direct infringement

because Lenovo, with knowledge of the '560 patent, knowingly and intentionally encourages end-users to operate the Blu-ray drives in the Lenovo Accused Products by, among other means, providing instructions for use of the Lenovo Accused Products, providing technical support to such end users, and advertising the Lenovo Accused Products for use in an infringing manner. Lenovo contributes to end-users' infringement of the '560 patent by offering for sale, selling, importing into the United States, distributing, supplying, and/or otherwise providing the Lenovo Accused Products for use by end-users with knowledge that the Blu-ray drives in the Lenovo Accused Products are designed for use in a manner that practices the inventions claimed in the '560 patent, and that the Blu-ray drives in the Lenovo Accused Products do not have substantial non-infringing uses.

68. Defendant LG and LG USA make or have made, use, offer to sell, sell, distribute, supply, provide, and/or import into the United States products that include Blu-ray drives, including but not limited to Blu-ray disc player models BD690, BD670, BD640, BD630, BX580, BD590, BD570 and BD550, home theater system models LHB975, LHB535 and LHB335, Blu-ray disc drive model BP06LU10, and storage device model N2B1DD1 (collectively, "the LG Accused Products"). LG and LG USA directly infringe the '560 patent by, among other activities, operating the Blu-ray drive in the LG Accused Products. LG and LG USA are also indirectly liable for the direct infringement of the '560 patent by others. Consumers and other users of the Blu-ray drive in the LG Accused Products directly infringe the '560 patent when they operate the Blu-ray drive in the LG Accused Products for personal use or otherwise. LG and LG USA induce such end-users' direct infringement because LG and LG USA, with knowledge of the '560 patent, knowingly and intentionally encourage end-users to operate the Blu-ray drives in the LG Accused Products by, among other means, providing instructions for use of the LG Accused Products, providing technical support to such end users, and advertising the LG Accused Products for use in an infringing manner. LG and LG USA contribute to end-users' infringement of the '560 patent by offering for sale, selling, importing into the United States, distributing, supplying, and/or otherwise providing the LG Accused Products for use by end-users with knowledge that the Blu-ray drives in the LG Accused Products are designed for use in a manner

that practices the inventions claimed in the '560 patent, and that the Blu-ray drives in the LG Accused Products do not have substantial non-infringing uses.

69. Defendants Lite-On and Lite-On Americas make, use, offer to sell, sell, distribute, supply, provide, and/or import into the United States products that include Blu-ray drives, including but not limited to internal Blu-ray writers iHBS212-08 and iHBS112-29, and Blu-ray combo drives IHES208-08 and iHES108-29 (collectively, "the Lite-On Accused Products"). Lite-On and Lite-On Americas directly infringe the '560 patent by, among other activities, operating the Blu-ray drive in the Lite-On Accused Products. Lite-On and Lite-On Americas are also indirectly liable for the direct infringement of the '560 patent by others. Consumers and other users of the Blu-ray drive in the Lite-On Accused Products directly infringe the '560 patent when they operate the Blu-ray drive in the Lite-On Accused Products for personal use or otherwise. Lite-On and Lite-On Americas induce such end-users' direct infringement because Lite-On and Lite-On Americas, with knowledge of the '560 patent, knowingly and intentionally encourage end-users to operate the Blu-ray drives in the Lite-On Accused Products by, among other means, providing instructions for use of the Lite-On Accused Products, providing technical support to such end users, and advertising the Lite-On Accused Products for use in an infringing manner. Lite-On and Lite-On Americas contribute to end-users' infringement of the '560 patent by offering for sale, selling, importing into the United States, distributing, supplying, and/or otherwise providing the Lite-On Accused Products for use by end-users with knowledge that the Blu-ray drives in the Lite-On Accused Products are designed for use in a manner that practices the inventions claimed in the '560 patent, and that the Blu-ray drives in the Lite-On Accused Products do not have substantial non-infringing uses.

70. Defendants Microstar and MSI make, use, offer to sell, sell, distribute, supply, provide, and/or import into the United States products that include Blu-ray drives, including but not limited to desktop computer model AE2420 3D-046US and notebook computer model FX700-056US (collectively, "the Microstar Accused Products"). Microstar and MSI directly infringe the '560 patent by, among other activities, operating the Blu-ray drive in the Microstar Accused Products. Microstar and MSI are also indirectly liable for the direct infringement of the

'560 patent by others. Consumers and other users of the Blu-ray drive in the Microstar Accused Products directly infringe the '560 patent when they operate the Blu-ray drive in the Microstar Accused Products for personal use or otherwise. Microstar and MSI induce such end-users' direct infringement because Microstar and MSI, with knowledge of the '560 patent, knowingly and intentionally encourage end-users to operate the Blu-ray drives in the Microstar Accused Products by, among other means, providing instructions for use of the Microstar Accused Products, providing technical support to such end users, and advertising the Microstar Accused Products for use in an infringing manner. Microstar and MSI contribute to end-users' infringement of the '560 patent by offering for sale, selling, importing into the United States, distributing, supplying, and/or otherwise providing the Microstar Accused Products for use by end-users with knowledge that the Blu-ray drives in the Microstar Accused Products are designed for use in a manner that practices the inventions claimed in the '560 patent, and that the Blu-ray drives in the Microstar Accused Products do not have substantial non-infringing uses.

71. Defendants NAD and NAD America make, use, offer to sell, sell, distribute, supply, provide, and/or import into the United States products that include Blu-ray drives, including but not limited to Blu-ray disc player models T-587, T-577, T557 and M56 (collectively, "the NAD Accused Products"). NAD and NAD America directly infringe the '560 patent by, among other activities, operating the Blu-ray drive in the NAD Accused Products. NAD and NAD America are also indirectly liable for the direct infringement of the '560 patent by others. Consumers and other users of the Blu-ray drive in the NAD Accused Products directly infringe the '560 patent when they operate the Blu-ray drive in the NAD Accused Products for personal use or otherwise. NAD and NAD America induce such end-users' direct infringement because NAD and NAD America, with knowledge of the '560 patent, knowingly and intentionally encourage end-users to operate the Blu-ray drives in the NAD Accused Products by, among other means, providing instructions for use of the NAD Accused Products, providing technical support to such end users, and advertising the NAD Accused Products for use in an infringing manner. NAD and NAD America contribute to end-users' infringement of the '560 patent by offering for sale, selling, importing into the United States, distributing, supplying,

and/or otherwise providing the NAD Accused Products for use by end-users with knowledge that the Blu-ray drives in the NAD Accused Products are designed for use in a manner that practices the inventions claimed in the '560 patent, and that the Blu-ray drives in the NAD Accused Products do not have substantial non-infringing uses.

72. Defendants Onkyo and Onkyo USA make, use, offer to sell, sell, distribute, supply, provide, and/or import into the United States products that include Blu-ray drives, including but not limited to Blu-ray disc player models BD-SP308, BD-SP807, BD-SP808, and DV-BD606 (collectively, "the Onkyo Accused Products"). Onkyo and Onkyo USA directly infringe the '560 patent by, among other activities, operating the Blu-ray drive in the Onkyo Accused Products. Onkyo and Onkyo USA are also indirectly liable for the direct infringement of the '560 patent by others. Consumers and other users of the Blu-ray drive in the Onkyo Accused Products directly infringe the '560 patent when they operate the Blu-ray drive in the Onkyo Accused Products for personal use or otherwise. Onkyo and Onkyo USA induce such end-users' direct infringement because Onkyo and Onkyo USA, with knowledge of the '560 patent, knowingly and intentionally encourage end-users to operate the Blu-ray drives in the Onkyo Accused Products by, among other means, providing instructions for use of the Onkyo Accused Products, providing technical support to such end users, and advertising the Onkyo Accused Products for use in an infringing manner. Onkyo and Onkyo USA contribute to end-users' infringement of the '560 patent by offering for sale, selling, importing into the United States, distributing, supplying, and/or otherwise providing the Onkyo Accused Products for use by end-users with knowledge that the Blu-ray drives in the Onkyo Accused Products are designed for use in a manner that practices the inventions claimed in the '560 patent, and that the Blu-ray drives in the Onkyo Accused Products do not have substantial non-infringing uses.

73. Defendant OPPO makes or has made, uses, offers to sell, sells, distributes, supplies, provides and/or imports into the United States products that include Blu-ray drives, including but not limited to Blu-ray player models BDP-83, BDP-93, and BDP-95 (collectively, "the OPPO Accused Products"). OPPO directly infringes the '560 patent by, among other activities, operating the Blu-ray drive in the OPPO Accused Products. OPPO is also indirectly

liable for the direct infringement of the '560 patent by others. Consumers and other users of the Blu-ray drive in the OPPO Accused Products directly infringe the '560 patent when they operate the Blu-ray drive in the OPPO Accused Products for personal use or otherwise. OPPO induces such end-users' direct infringement because OPPO, with knowledge of the '560 patent, knowingly and intentionally encourages end-users to operate the Blu-ray drives in the OPPO Accused Products by, among other means, providing instructions for use of the OPPO Accused Products, providing technical support to such end users, and advertising the OPPO Accused Products for use in an infringing manner. OPPO contributes to end-users' infringement of the '560 patent by offering for sale, selling, importing into the United States, distributing, supplying, and/or otherwise providing the OPPO Accused Products for use by end-users with knowledge that the Blu-ray drives in the OPPO Accused Products are designed for use in a manner that practices the inventions claimed in the '560 patent, and that the Blu-ray drives in the OPPO Accused Products do not have substantial non-infringing uses.

74. Defendants Panasonic and Panasonic NA make, use, offer to sell, sell, distribute, supply, provide, and/or import into the United States products that include Blu-ray drives, including but not limited to Blu-ray disc player models DMP-BD35K, DMP-BD55K, DMP-BD60K, DMP-BD70VK, DMP-BD80K, DMP-BD605K, DMP-BD601K, DMP-BD65K, DMP-BD655K, DMP-BD85K, DMP-BD45, DMP-BDT350 and DMP-BDT300, portable Blu-ray disc player models DMP-B15K, DMP-B100 and DMP-B500, and Blu-ray disc home theater system models SC-BT100, SC-BT200, SC-BT300, SC-BT203, SC-BT303, SC-BT730, SC-BT330, SC-BT230, SC-BT235 and SC-BT228 (collectively, "the Panasonic Accused Products"). Panasonic and Panasonic NA directly infringe the '560 patent by, among other activities, operating the Blu-ray drive in the Panasonic Accused Products. Panasonic and Panasonic NA are also indirectly liable for the direct infringement of the '560 patent by others. Consumers and other users of the Blu-ray drive in the Panasonic Accused Products directly infringe the '560 patent when they operate the Blu-ray drive in the Panasonic Accused Products for personal use or otherwise. Panasonic and Panasonic NA induce such end-users' direct infringement because Panasonic and Panasonic NA, with knowledge of the '560 patent, knowingly and intentionally encourage end-

users to operate the Blu-ray drives in the Panasonic Accused Products by, among other means, providing instructions for use of the Panasonic Accused Products, providing technical support to such end users, and advertising the Panasonic Accused Products for use in an infringing manner. Panasonic and Panasonic NA contribute to end-users' infringement of the '560 patent by offering for sale, selling, importing into the United States, distributing, supplying, and/or otherwise providing the Panasonic Accused Products for use by end-users with knowledge that the Blu-ray drives in the Panasonic Accused Products are designed for use in a manner that practices the inventions claimed in the '560 patent, and that the Blu-ray drives in the Panasonic Accused Products do not have substantial non-infringing uses.

75. Defendants Philips and Philips NA make or have made, use, offer to sell, sell, distribute, supply, provide, and/or import into the United States products that include Blu-ray drives, including but not limited to Blu-ray disc player models BDP3020/F7 and BDP7320/F7, home theater system model HTS3251B/F7 and portable Blu-ray player model PB9011/37 (collectively, "the Philips Accused Products"). Philips and Philips NA directly infringe the '560 patent by, among other activities, operating the Blu-ray drive in the Philips Accused Products. Philips and Philips NA are also indirectly liable for the direct infringement of the '560 patent by others. Consumers and other users of the Blu-ray drive in the Philips Accused Products directly infringe the '560 patent when they operate the Blu-ray drive in the Philips Accused Products for personal use or otherwise. Philips and Philips NA induce such end-users' direct infringement because Philips and Philips NA, with knowledge of the '560 patent, knowingly and intentionally encourage end-users to operate the Blu-ray drives in the Philips Accused Products by, among other means, providing instructions for use of the Philips Accused Products, providing technical support to such end users, and advertising the Philips Accused Products for use in an infringing manner. Philips and Philips NA contribute to end-users' infringement of the '560 patent by offering for sale, selling, importing into the United States, distributing, supplying, and/or otherwise providing the Philips Accused Products for use by end-users with knowledge that the Blu-ray drives in the Philips Accused Products are designed for use in a manner that practices the inventions claimed in the '560 patent, and that the Blu-ray drives in the Philips Accused Products

do not have substantial non-infringing uses.

76. Defendants Pioneer and Pioneer USA make or have made, use, offer to sell, sell, distribute, supply, provide, and/or import into the United States products that include Blu-ray drives, including but not limited to Blu-ray disc player models BDP-09FD, BDP-23FD, BDP-05FD, BDP-320, BDP-120 and BDP-51FD, and Blu-ray disc drive models BDR-2205 and BDR-205 (collectively, "the Pioneer Accused Products"). Pioneer and Pioneer USA directly infringe the '560 patent by, among other activities, operating the Blu-ray drive in the Pioneer Accused Products. Pioneer and Pioneer USA are also indirectly liable for the direct infringement of the '560 patent by others. Consumers and other users of the Blu-ray drive in the Pioneer Accused Products directly infringe the '560 patent when they operate the Blu-ray drive in the Pioneer Accused Products for personal use or otherwise. Pioneer and Pioneer USA induce such end-users' direct infringement because Pioneer and Pioneer USA, with knowledge of the '560 patent, knowingly and intentionally encourage end-users to operate the Blu-ray drives in the Pioneer Accused Products by, among other means, providing instructions for use of the Pioneer Accused Products, providing technical support to such end users, and advertising the Pioneer Accused Products for use in an infringing manner. Pioneer and Pioneer USA contribute to end-users' infringement of the '560 patent by offering for sale, selling, importing into the United States, distributing, supplying, and/or otherwise providing the Pioneer Accused Products for use by end-users with knowledge that the Blu-ray drives in the Pioneer Accused Products are designed for use in a manner that practices the inventions claimed in the '560 patent, and that the Blu-ray drives in the Pioneer Accused Products do not have substantial non-infringing uses.

77. Defendants SEA and SEC make or have made, use, used, offer to sell, sell, distribute, supply, provide, and/or import into the United States products that include Blu-ray drives, including but not limited to home theater system models HT-BD8200, Blu-ray disc player models BD-C8000, BD-C7500, BD-C6900, BD-C6800, BD-C6500, BD-C5900 and BD-C5500, computer models R540-11, R480, and R580, and Blu-ray disc drive models SH-B123L, SH-B123A, SH-083L and SH-083A (collectively, "the Samsung Accused Products"). SEA and SEC directly infringe the '560 patent by, among other activities, operating the Blu-ray drive in the

Samsung Accused Products. SEA and SEC are also indirectly liable for the direct infringement of the '560 patent by others. Consumers and other users of the Blu-ray drive in the Samsung Accused Products directly infringe the '560 patent when they operate the Blu-ray drive in the Samsung Accused Products for personal use or otherwise. SEA and SEC induce such end-users' direct infringement because SEA and SEC, with knowledge of the '560 patent, knowingly and intentionally encourage end-users to operate the Blu-ray drives in the Samsung Accused Products by, among other means, providing instructions for use of the Samsung Accused Products, providing technical support to such end users, and advertising the Samsung Accused Products for use in an infringing manner. SEA and SEC contribute to end-users' infringement of the '560 patent by offering for sale, selling, importing into the United States, distributing, supplying, and/or otherwise providing the Samsung Accused Products for use by end-users with knowledge that the Blu-ray drives in the Samsung Accused Products are designed for use in a manner that practices the inventions claimed in the '560 patent, and that the Blu-ray drives in the Samsung Accused Products do not have substantial non-infringing uses.

78. Defendants Sharp and Sharp Electronics make or have made, use, used, offer to sell, sell, distribute, supply, provide, and/or import into the United States products that include Blu-ray drives, including but not limited to Blu-ray disc player models BD-HP24U and BD-HP70U, and Blu-ray disc home theater system models BD-MPC41U (collectively, "the Sharp Accused Products"). Sharp and Sharp Electronics directly infringe the '560 patent by, among other activities, operating the Blu-ray drive in the Sharp Accused Products. Sharp and Sharp Electronics are also indirectly liable for the direct infringement of the '560 patent by others. Consumers and other users of the Blu-ray drive in the Sharp Accused Products directly infringe the '560 patent when they operate the Blu-ray drive in the Sharp Accused Products for personal use or otherwise. Sharp and Sharp Electronics induce such end-users' direct infringement because Sharp and Sharp Electronics, with knowledge of the '560 patent, knowingly and intentionally encourage end-users to operate the Blu-ray drives in the Sharp Accused Products by, among other means, providing instructions for use of the Sharp Accused Products, providing technical support to such end users, and advertising the Sharp Accused Products for use in an

infringing manner. Sharp and Sharp Electronics contribute to end-users' infringement of the '560 patent by offering for sale, selling, importing into the United States, distributing, supplying, and/or otherwise providing the Sharp Accused Products for use by end-users with knowledge that the Blu-ray drives in the Sharp Accused Products are designed for use in a manner that practices the inventions claimed in the '560 patent, and that the Blu-ray drives in the Sharp Accused Products do not have substantial non-infringing uses.

79. Defendants Toshiba and TAIS make or have made, use, used, offer to sell, sell, distribute, supply, provide, and/or import into the United States products that include Blu-ray drives, including but not limited to Blu-ray disc player models BDX2700, BDX2500, BDX2000 and BDX3000 (collectively, "the Toshiba Accused Products"). Toshiba and TAIS directly infringe the '560 patent by, among other activities, operating the Blu-ray drive in the Toshiba Accused Products. Toshiba and TAIS are also indirectly liable for the direct infringement of the '560 patent by others. Consumers and other users of the Blu-ray drive in the Toshiba Accused Products directly infringe the '560 patent when they operate the Blu-ray drive in the Toshiba Accused Products for personal use or otherwise. Toshiba and TAIS induce such end-users' direct infringement because Toshiba and TAIS, with knowledge of the '560 patent, knowingly and intentionally encourage end-users to operate the Blu-ray drives in the Toshiba Accused Products by, among other means, providing instructions for use of the Toshiba Accused Products, providing technical support to such end users, and advertising the Toshiba Accused Products for use in an infringing manner. Toshiba and TAIS contribute to end-users' infringement of the '560 patent by offering for sale, selling, importing into the United States, distributing, supplying, and/or otherwise providing the Toshiba Accused Products for use by end-users with knowledge that the Blu-ray drives in the Toshiba Accused Products are designed for use in a manner that practices the inventions claimed in the '560 patent, and that the Blu-ray drives in the Toshiba Accused Products do not have substantial non-infringing uses.

80. Defendants ViewSonic and ViewSonic International make or have made, use, offer to sell, sell, distribute, supply, provide and/or import into the United States products that include Blu-ray drives, including but not limited to Blu-ray player model VOT550 (collectively,

"the ViewSonic Accused Products"). ViewSonic and ViewSonic International directly infringe the '560 patent by, among other activities, operating the Blu-ray drive in the ViewSonic Accused Products. ViewSonic and ViewSonic International are also indirectly liable for the direct infringement of the '560 patent by others. Consumers and other users of the Blu-ray drive in the ViewSonic Accused Products directly infringe the '560 patent when they operate the Blu-ray drive in the ViewSonic Accused Products for personal use or otherwise. ViewSonic and ViewSonic International induce such end-users' direct infringement because ViewSonic and ViewSonic International, with knowledge of the '560 patent, knowingly and intentionally encourage end-users to operate the Blu-ray drives in the ViewSonic Accused Products by, among other means, providing instructions for use of the ViewSonic Accused Products, providing technical support to such end users, and advertising the ViewSonic Accused Products for use in an infringing manner. ViewSonic and ViewSonic International contribute to end-users' infringement of the '560 patent by offering for sale, selling, importing into the United States, distributing, supplying, and/or otherwise providing the ViewSonic Accused Products for use by end-users with knowledge that the Blu-ray drives in the ViewSonic Accused Products are designed for use in a manner that practices the inventions claimed in the '560 patent, and that the Blu-ray drives in the ViewSonic Accused Products do not have substantial non-infringing uses.

81. Defendant Vizio makes or has made, uses, offers to sell, sells, distributes, supplies, provides and/or imports into the United States products that include Blu-ray drives, including but not limited to Blu-ray player models VBR231, VBR122 and VBR133 (collectively, "the Vizio Accused Products"). Vizio directly infringes the '560 patent by, among other activities, operating the Blu-ray drive in the Vizio Accused Products. Vizio is also indirectly liable for the direct infringement of the '560 patent by others. Consumers and other users of the Blu-ray drive in the Vizio Accused Products directly infringe the '560 patent when they operate the Blu-ray drive in the Vizio Accused Products for personal use or otherwise. Vizio induces such end-users' direct infringement because Vizio, with knowledge of the '560 patent, knowingly and intentionally encourages end-users to operate the Blu-ray drives in the Vizio Accused Products by, among other means, providing instructions for use of the Vizio Accused Products, providing technical

support to such end users, and advertising the Vizio Accused Products for use in an infringing manner. Vizio contributes to end-users' infringement of the '560 patent by offering for sale, selling, importing into the United States, distributing, supplying, and/or otherwise providing the Vizio Accused Products for use by end-users with knowledge that the Blu-ray drives in the Vizio Accused Products are designed for use in a manner that practices the inventions claimed in the '560 patent, and that the Blu-ray drives in the Vizio Accused Products do not have substantial non-infringing uses.

82. Defendants Yamaha, Yamaha America, and Yamaha USA make or have made, use, offer to sell, sell, distribute, supply, provide and/or import into the United States products that include Blu-ray drives, including but not limited to Blu-ray players such as models BD-A1000, BD-S667, BD-S1900, BD-S1065 (collectively, "the Yamaha Accused Products"). Yamaha, Yamaha America, and Yamaha USA directly infringe the '560 patent by, among other activities, operating the Blu-ray drive in the Yamaha Accused Products. Yamaha, Yamaha America, and Yamaha USA are also indirectly liable for the direct infringement of the '560 patent by others. Consumers and other users of the Blu-ray drive in the Yamaha Accused Products directly infringe the '560 patent when they operate the Blu-ray drive in the Yamaha Accused Products for personal use or otherwise. Yamaha, Yamaha America, and Yamaha USA induce such end-users' direct infringement because Yamaha, Yamaha America, and Yamaha USA, with knowledge of the '560 patent, knowingly and intentionally encourage end-users to operate the Blu-ray drives in the Yamaha Accused Products by, among other means, providing instructions for use of the Yamaha Accused Products, providing technical support to such end users, and advertising the Yamaha Accused Products for use in an infringing manner. Yamaha, Yamaha America, and Yamaha USA contribute to end-users' infringement of the '560 patent by offering for sale, selling, importing into the United States, distributing, supplying, and/or otherwise providing the Yamaha Accused Products for use by end-users with knowledge that the Blu-ray drives in the Yamaha Accused Products are designed for use in a manner that practices the inventions claimed in the '560 patent, and that the Blu-ray drives in the Yamaha Accused Products do not have substantial non-infringing uses.

83. Defendants' infringement of the '560 patent has harmed Orinda, entitling Orinda to recover from the Defendants the damages Orinda has sustained as a result of Defendants' wrongful acts. Defendants' infringement of the '560 patent will continue to damage Orinda and will cause irreparable harm to Orinda for which there is no adequate remedy at law unless enjoined by this Court.

PRAYER FOR RELIEF

Orinda prays for relief as follows:

1. Judgment that each defendant has infringed the '560 patent as alleged herein, directly and/or indirectly through inducement of infringement or contributory infringement;

2. A judgment and order requiring each defendant to pay Orinda compensatory damages in an amount according to proof but in no event less than a reasonable royalty;

3. A judgment and order that each defendant, its agents, employees, representatives, successors and assigns, and those acting in privity or in concert with them, be permanently enjoined from further infringing the '560 patent. In the alternative, a judgment and order that each defendant pay Orinda an on-going royalty for future acts of infringement, at a rate determined by the jury or the Court;

4. Any and all other relief that the Court deems just and equitable.

Dated: July 6, 2011

FREITAS TSENG BAIK & KAUFMAN, LLP

By: */s/ Craig R. Kaufman /s/*
Craig R. Kaufman
Attorney for Plaintiff Orinda Intellectual Properties USA Holding Group, Inc.

DEMAND FOR A JURY TRIAL

Pursuant to Fed. R. Civ. P. 38(b) and L.R. 3.6(a), Orinda respectfully requests a trial by jury on all issues.

Dated: July 6, 2011

FREITAS TSENG BAIK & KAUFMAN, LLP

By: */s/ Craig R. Kaufman /s/*
Craig R. Kaufman
Attorney for Plaintiff Orinda Intellectual Properties USA Holding Group, Inc.

Exhibit A

US005438560A

United States Patent [19]

Lee

[11] Patent Number: 5,438,560

[45] Date of Patent: Aug. 1, 1995

[54] **APPARATUS AND METHOD FOR RECORDING/REPRODUCING OPTICAL INFORMATION AND OPTICAL DISK-SHAPED RECORDING MEDIUM**

[75] Inventor: **Si H. Lee**, Kyoungki-do, Rep. of Korea

[73] Assignee: **Hyundai Electronics Industries Co., Ltd.**, Rep. of Korea

[21] Appl. No.: **139,033**

[22] Filed: **Oct. 21, 1993**

[30] **Foreign Application Priority Data**

Dec. 31, 1992 [KR] Rep. of Korea 27199

[51] **Int. Cl.**[6] **G11B 7/00**

[52] **U.S. Cl.** **369/58**; 369/54; 369/47; 369/48

[58] **Field of Search** 369/58, 47, 48, 49, 369/59, 54, 53, 424, 32

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,223,347	9/1980	Bouwhuis et al. .	
4,925,717	5/1990	Tsukamura et al. .	
5,111,444	5/1992	Fukushima et al.	369/58
5,235,585	8/1993	Bish et al.	369/58 X

Primary Examiner—Georgia Y. Epps
Assistant Examiner—Muhammad N. Edun
Attorney, Agent, or Firm—Wigman, Cohen, Leitner & Myers

[57] **ABSTRACT**

An optical disk-shaped recording medium comprising a plurality of tracks, the tracks constituting blocks in the unit of a predetermined number, each of the blocks being provided with a data region and a first mapping region, a second mapping region being further provided on a center one of the entire tracks, each of the first mapping regions including mapping sectors and replacement sectors, the second mapping region including; a mapping information recording region and a replacement sector region for the first mapping regions of the whole of the blocks, the mapping sectors of each of the first mapping regions recording mapping information about bad sectors of the corresponding block thereon, the replacement sectors of each of the first mapping regions being replaced for the bad sectors of the corresponding block, and an apparatus and a method for recording/reproducing optical information using the optical disk-shaped recording medium.

3 Claims, 6 Drawing Sheets

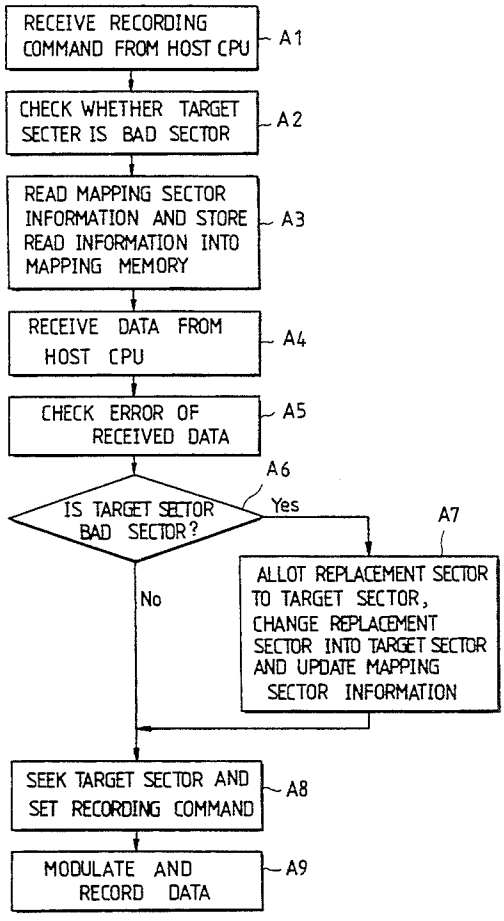


FIG. 1

(Prior Art)

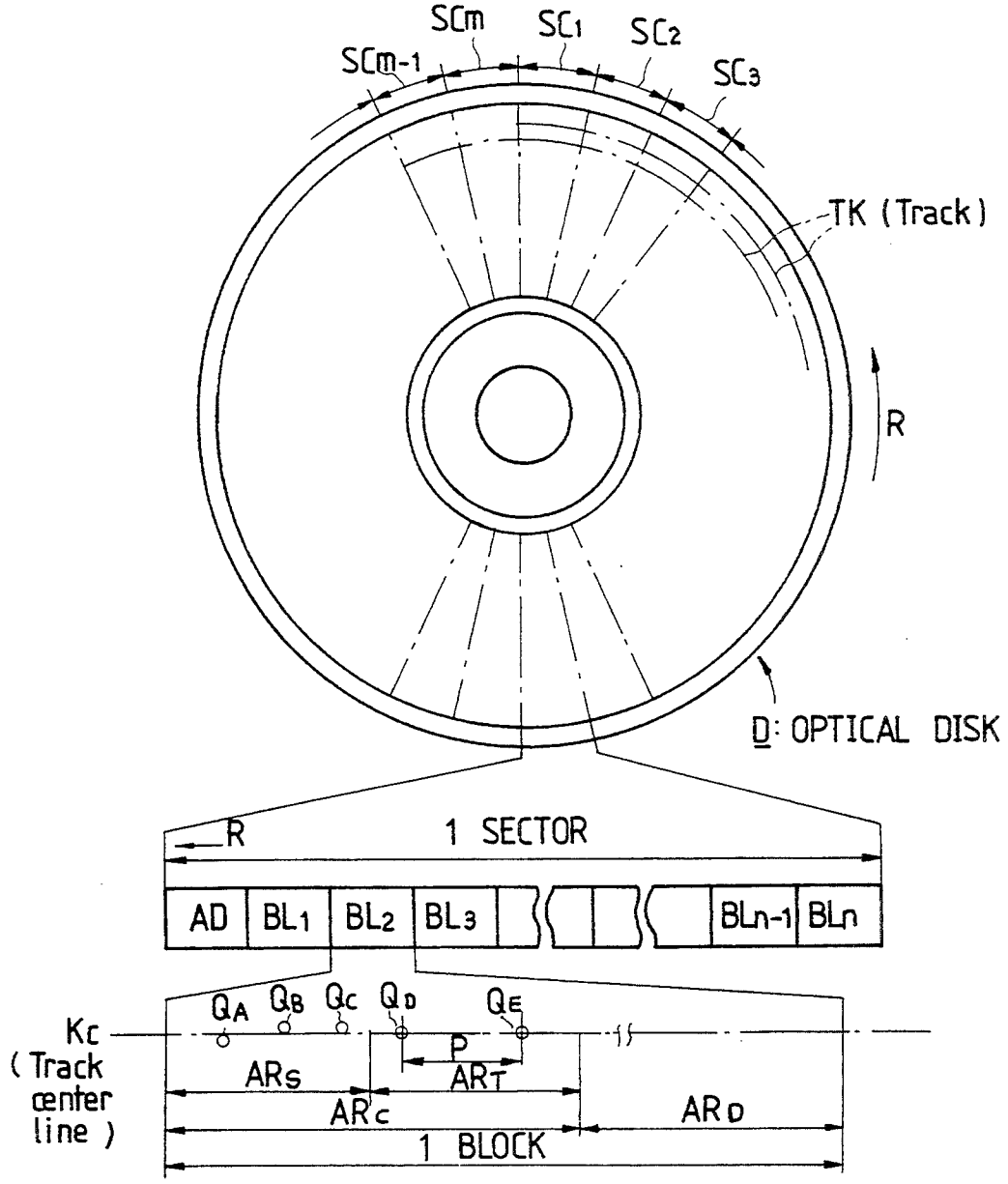


FIG. 2

(Prior Art)

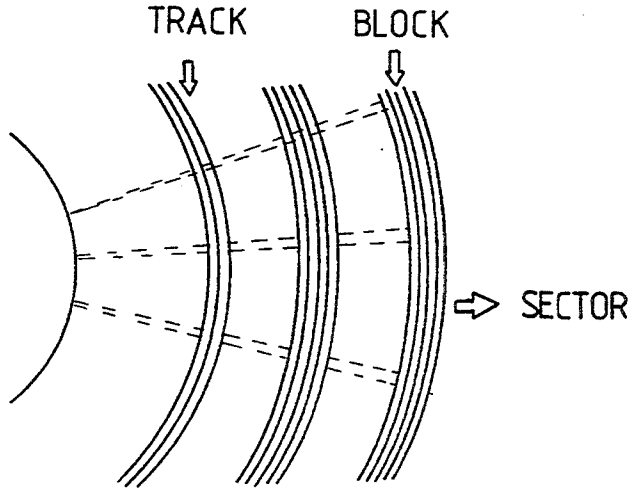


FIG. 3

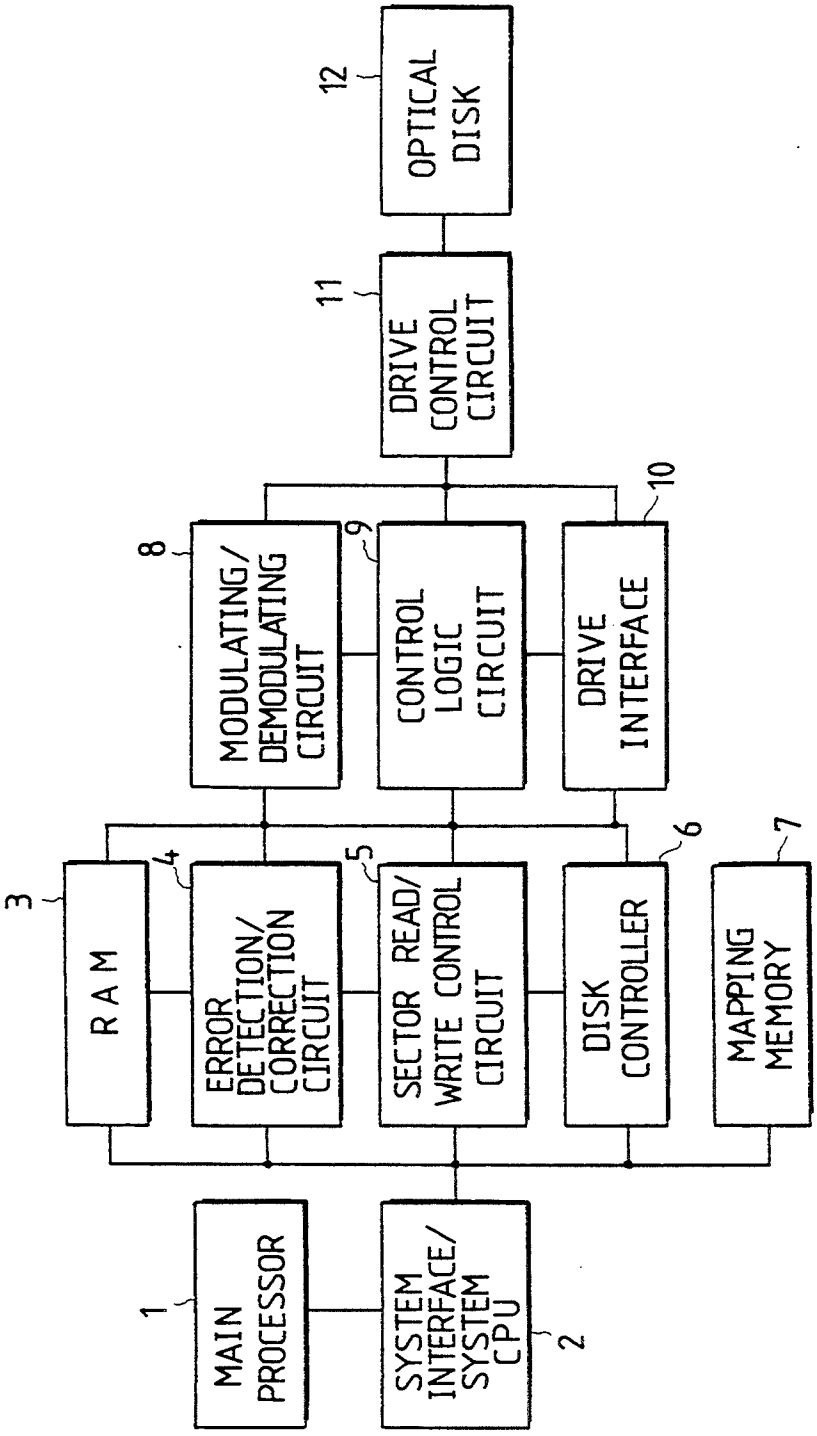

12
OPTICAL DISK
11
DRIVE CONTROL CIRCUIT
8
MODULATING/ DEMODULATING CIRCUIT
9
CONTROL LOGIC CIRCUIT
10
DRIVE INTERFACE
3
RAM
4
ERROR DETECTION/ CORRECTION CIRCUIT
5
SECTOR READ/ WRITE CONTROL CIRCUIT
6
DISK CONTROLLER
7
MAPPING MEMORY
1
MAIN PROCESSOR
SYSTEM INTERFACE/ SYSTEM CPU
2

FIG. 4

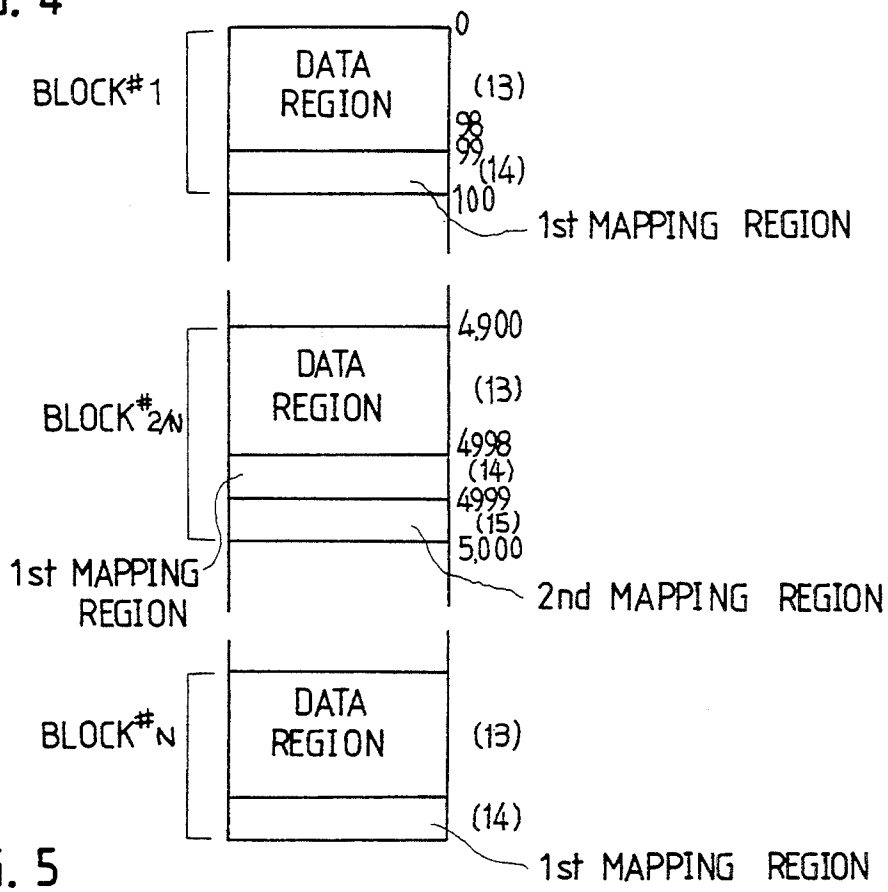


FIG. 5

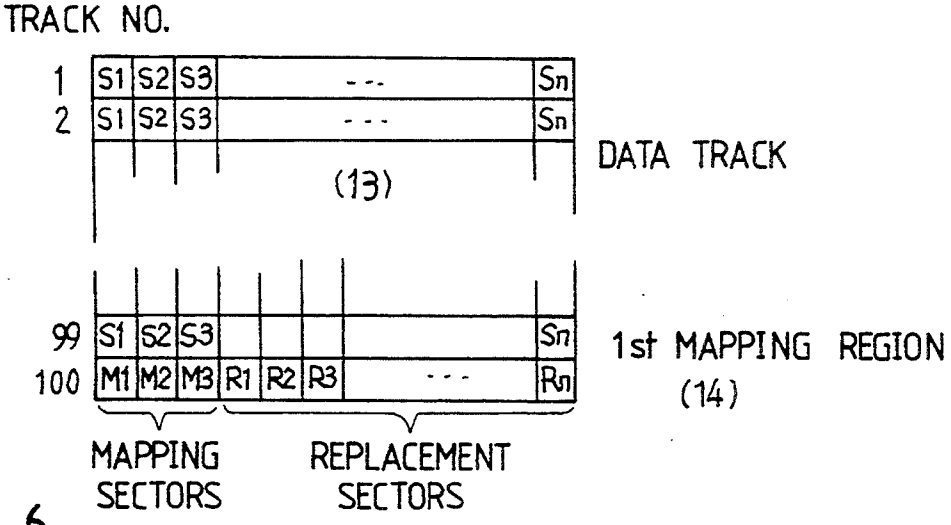


FIG. 6

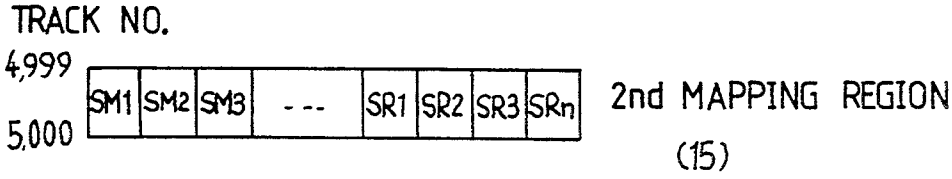


FIG. 7

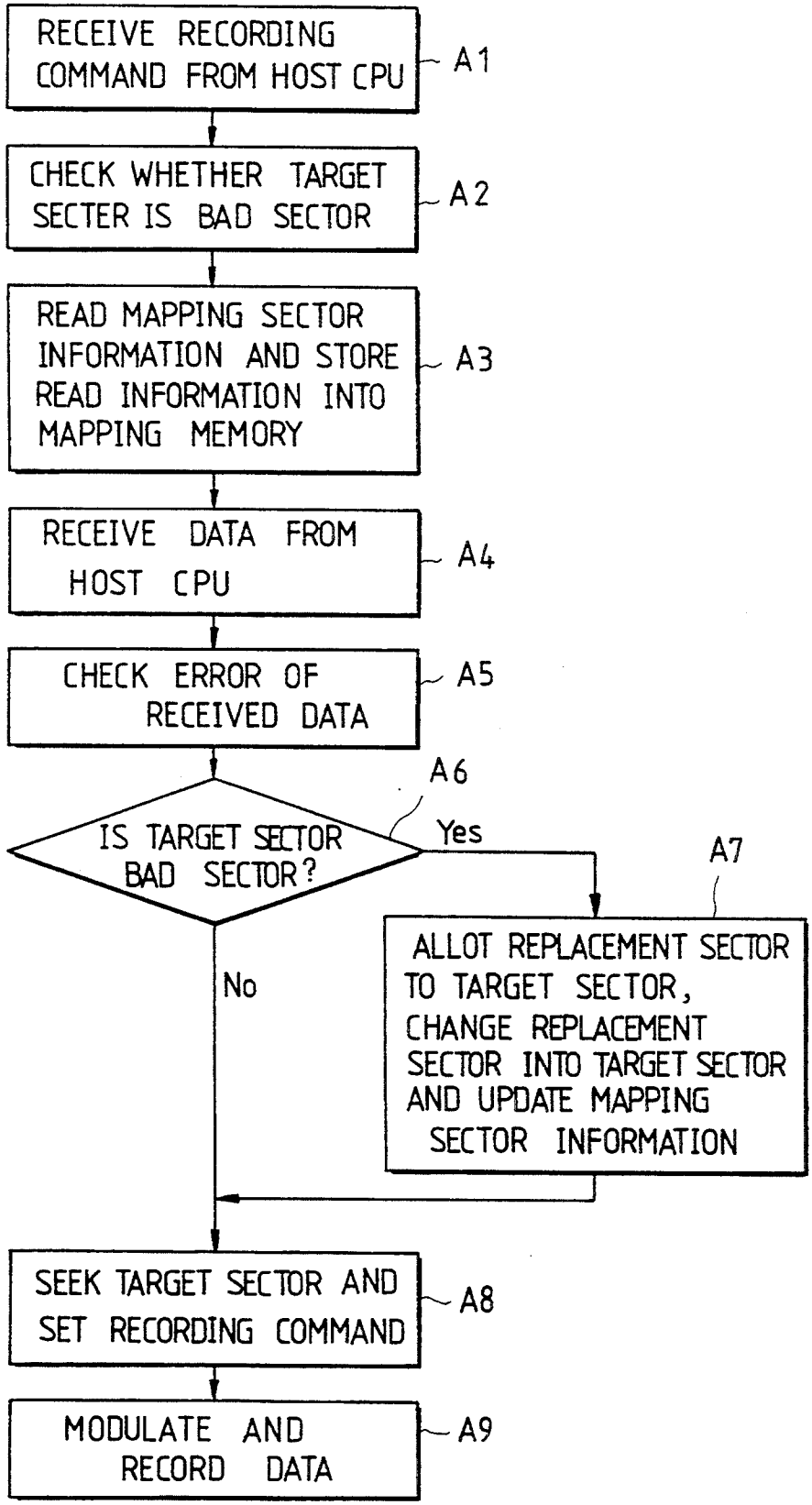
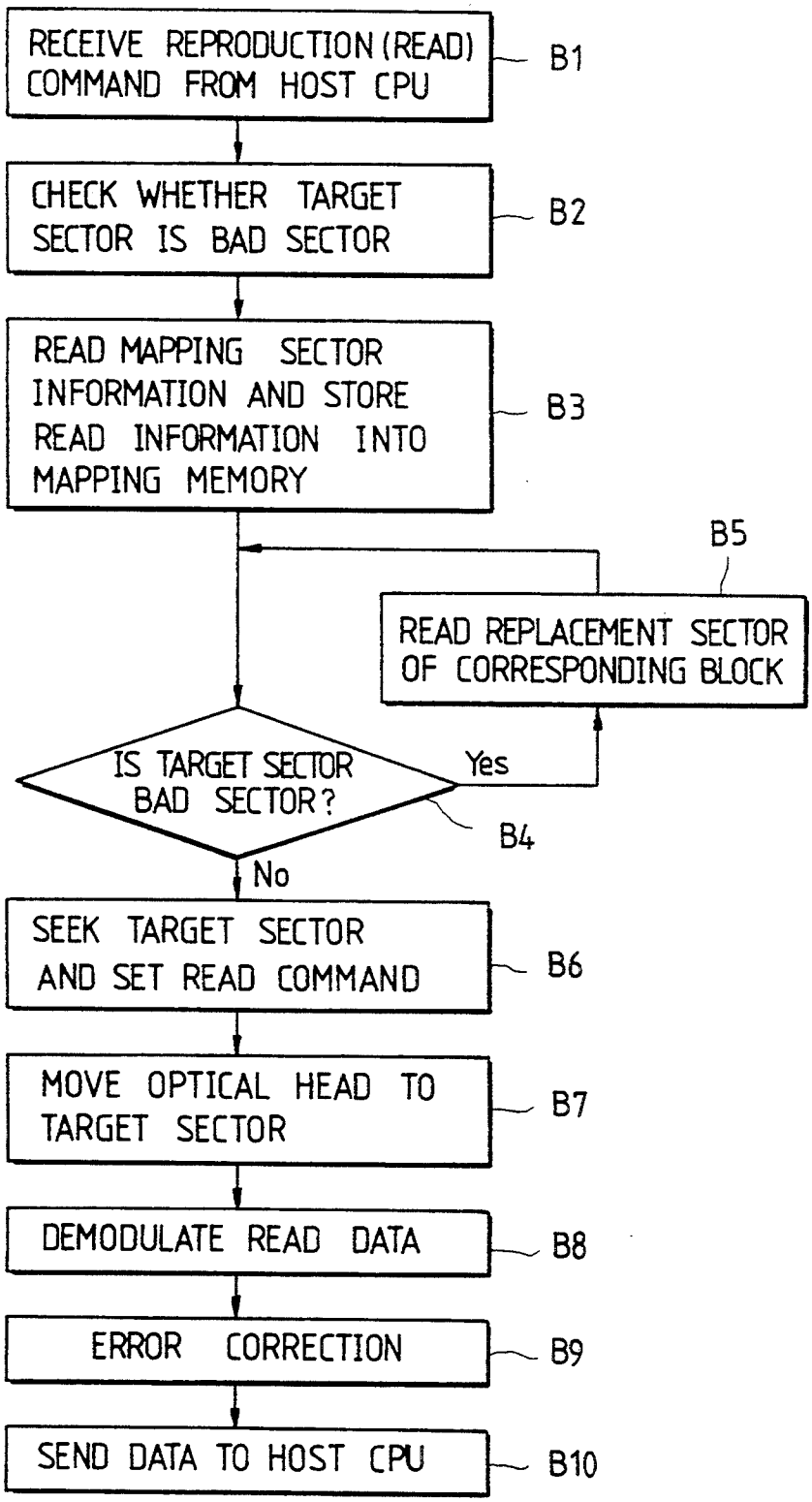

RECEIVE RECORDING COMMAND FROM HOST CPU
A1
CHECK WHETHER TARGET SECTER IS BAD SECTOR
A2
READ MAPPING SECTOR INFORMATION AND STORE READ INFORMATION INTO MAPPING MEMORY
A3
RECEIVE DATA FROM HOST CPU
A4
CHECK ERROR OF RECEIVED DATA
A5
A6
IS TARGET SECTOR BAD SECTOR?
Yes
No
A7
ALLOT REPLACEMENT SECTOR TO TARGET SECTOR, CHANGE REPLACEMENT SECTOR INTO TARGET SECTOR AND UPDATE MAPPING SECTOR INFORMATION
SEEK TARGET SECTOR AND SET RECORDING COMMAND
A8
MODULATE AND RECORD DATA
A9

FIG. 8


RECEIVE REPRODUCTION (READ) COMMAND FROM HOST CPU
B1
CHECK WHETHER TARGET SECTOR IS BAD SECTOR
B2
READ MAPPING SECTOR INFORMATION AND STORE READ INFORMATION INTO MAPPING MEMORY
B3
B5
READ REPLACEMENT SECTOR OF CORRESPONDING BLOCK
IS TARGET SECTOR BAD SECTOR?
Yes
B4
No
SEEK TARGET SECTOR AND SET READ COMMAND
B6
MOVE OPTICAL HEAD TO TARGET SECTOR
B7
DEMODULATE READ DATA
B8
ERROR CORRECTION
B9
SEND DATA TO HOST CPU
B10

APPARATUS AND METHOD FOR RECORDING/REPRODUCING OPTICAL INFORMATION AND OPTICAL DISK-SHAPED RECORDING MEDIUM

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates in general to the recording/reproduction of optical information, and more particularly to an optical disk-shaped recording medium in which tracks constitute blocks in the unit of a predetermined number, each of the blocks being provided with a data region and a first mapping region, a second mapping region being further provided on one of the blocks having a center one of the tracks, each of the first mapping regions including mapping sectors and replacement sectors, the second mapping region including a mapping information recording region and a replacement sector region for the first mapping regions of the whole of the blocks, and an apparatus and a method for recording/reproducing optical information using the optical disk-shaped recording medium in which bad sectors of the entire tracks can efficiently be handled.

2. Description of the Prior Art

Generally, in recording media such as optical disks, the recording/reproduction of optical information is performed by applying a laser beam condensed in the order of 1 μm to the optical disks. At this time, various errors may be generated due to dust or alien substances on the surfaces of the optical disks and defects thereon. In the optical disk having a so-called track/sector construction, data is encoded and reproduced in the unit of sector for error detection and correction. Conventionally, since error detection/correction codes are in the unit of sector of 512 KByte, they cannot be applied to a disk having a considerable interleave length such as, for example, a compact disk (CD) not employing the sector construction. Also, in the case where burst errors affecting the entire sectors are generated, they cannot be corrected, resulting in abnormal reproduction of the data, differently from random errors occurring at a part of the sectors.

As one of methods for solving the above problem, there is known a replacement method for the optical disk of the recording type in which bad sectors are detected by a reading discrimination operation of reproducing the recorded data, just after the recording to discriminate whether the recorded data is accurately reproduced, and information on the detected bad sectors are recorded on replacement sectors which are formed on particular regions of the optical disk. However, the above-mentioned replacement method has a disadvantage in that the management of the replacement sectors is complex and difficult since the defects on the optical disk of the recording type are increased due to the natural life of the disk and the number of recording times, resulting in an increase in the replacement time.

Also, the optical disk of the reproduction-only type cannot employ the reading discrimination operation since it is stamped in large quantities in a manufacturing plant. As a result, all of the manufactured disks must be read again to search for bad ones among the disks. Reading all the manufactured disks results in an increase in the manufacturing cost.

In a conventional apparatus for recording/reproducing optical information using such an optical disk, in the case where data is repeatedly recorded on the same sector of the optical disk, a bad sector detection circuit detects an error in a sector address to a sector identifier and recognizes a sector of the detected error as a bad sector. In this case, data recorded on a data region cannot be detected ahead of the sector address to the sector identifier. For this reason, data may be recorded on the bad sector. This degrades the reliability.

FIG. 1 is a diagrammatic view illustrating a recording format of a conventional optical disk-shaped recording medium which is shown in U.S. Pat. No. 4,925,717. As shown in this drawing, the conventional optical disk-shaped recording medium comprises tracks, each of which includes a predetermined number of sectors SC (for example, 32 sectors). Each of the sectors SC is partitioned into a predetermined number of blocks BL1–BLn (for example, 42 blocks), each of which is provided with a control recording region (referred to hereinafter as ARC) and an information writing region (referred to hereinafter as ARD). The ARC is provided with a servo region (referred to hereinafter as ARS) and a traverse region (referred to hereinafter as ART). The ARS is provided with a pair of tracking information pits (referred to hereinafter as QA and QC) and a clock information pit (referred to hereinafter as QB). The ART is provided with a pair of traverse information pits (referred to hereinafter as QD and QE) every 16 consecutive tracks. The use of the QD and QE makes the counting of traverses more accurate and, thus, the tracking more accurate.

In other words, the QD and QE are provided on the ART at n interval from each other of a distance P. The QD is shifted at an interval of 4 consecutive tracks, whereas the QE is shifted for each track. The traverse counting is performed in the unit of track by the QD and QE. Therefore, data regarding the number and direction of track jumps can be obtained based on the QD and QE and the tracking can thus be performed more accurately on the basis of the obtained data.

However, the above-mentioned U.S Patent is desirable to make the tracking more accurate by performing the traverse counting at an interval of one track, but has the disadvantage that it cannot propose how to skip a bad sector resulting from an error of the disk and record information on the bad sector on a different region.

SUMMARY OF THE INVENTION

Therefore, the present invention has been made in view of the above problems, and it is an object of the present invention to provide an optical disk-shaped recording medium in which tracks constitute blocks in the unit of a predetermined number, each of the blocks being provided with a data region and a first mapping region, a second mapping region being further provided on a center one of the entire tracks, each of the first mapping regions including three mapping sectors provided at the head of the last track of each of the blocks and the subsequent replacement sectors provided on the same track, the second mapping region including a mapping information recording region and a replacement sector region for the first mapping regions of the whole of the blocks, and an apparatus and a method for recording/reproducing optical information using the optical. disk-shaped recording medium in which bad sectors of the entire tracks can efficiently be handled.

In accordance with one aspect of the present invention, there is provided an optical disk-shaped recording

medium comprising a plurality of tracks, said tracks constituting blocks in the unit of a predetermined number, each of said blocks being provided with a data region and a first mapping region, a second mapping region being further provided on a center one of the entire tracks, each of said first mapping regions including mapping sectors and replacement sectors, said second mapping region including a mapping information recording region and a replacement sector region for said first mapping regions of the whole of said blocks, said mapping sectors of each of said first mapping regions recording mapping information about bad sectors of the corresponding block thereon, said replacement sectors of each of said first mapping regions being replaced for the bad sectors of the corresponding block.

In accordance with another aspect of the present invention, there is provided an apparatus for recording-/reproducing optical information using an optical disk, comprising main processing means for controlling the entire operation of a system; system processing means for transferring a plurality of control signals from said main processing means to the associated components and controlling the associated components under the control of said main processing means; storage means for storing data from said system processing means; error detection/correction means for detecting an error of the data stored in said storing means and correcting the detected error; sector read/write control means for reading and writing a target sector address of the error detected by said error detection/correction means; disk control means for controlling the optical disk in response to the target sector address read from said sector read/write control means; mapping memory means for storing mapping sector information from said system processing means; modulating/demodulating means for modulating the data from said storage means and writing demodulated data into said storage means; control logic means for outputting a control signal in response to an output of said modulating/demodulating means; drive control means for driving the optical disk in response to the control signal from said control logic means; and drive interfacing means for transferring the control signal from said control logic means to said drive control means.

In accordance with a further aspect of the present invention, there is provided a method of recording optical information using an optical disk, comprising the steps of checking whether a target sector of the optical disk on which data is to be recorded is a bad sector, upon receiving a data recording command from main processing means; storing information into storage means in accordance with the checked result; reading information from mapping sectors of a block of the optical disk to which said target sector belongs and storing the read information into mapping memory means; receiving the data to be recorded from said main processing means and checking an error of the received data; checking whether said target sector is the bad sector; allotting a replacement sector of the optical disk to said target sector if it is checked that said target sector is the bad sector and updating the mapping sector information in said mapping memory means; seeking said target sector if it is checked that said target sector is normal and setting the recording command in sector read/write control means so that the data can be recorded on said target sector; and modulating the data and recording the modulated data on said target sector.

In accordance with yet another aspect of the present invention, there is provided a method of reproducing optical information using an optical disk, comprising the steps of checking whether a target sector of the optical disk from which data is to be reproduced is a bad sector, upon receiving a data reproduction command from main processing means; storing information into storage means in accordance with the checked result; reading information from mapping sectors of a block of the optical disk to which said target sector belongs and storing the read information into mapping memory means; checking whether said target sector is the bad sector; reading a replacement sector of the corresponding block if it is checked that said target sector is the bad sector; seeking said target sector if it is checked that said target sector is normal and setting the reproduction command in sector read/write control means so that the data can be reproduced from said target sector; moving an optical head to said target sector; demodulating the ;data read by said optical head; correcting an error of the demodulated data and storing the error-corrected data into said storage means; and sending the error-corrected data stored in said storage means to said main processing means through system processing means.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. **1** is a diagrammatic view illustrating a recording format of a conventional optical disk-shaped recording medium;

FIG. **2** is a diagrammatic view illustrating a construction of a general optical disk;

FIG. **3** is a block diagram of an apparatus for recording/reproducing optical information in accordance with the present invention;

FIG. **4** is a diagrammatic view illustrating data and mapping regions of an optical disk in accordance with the present invention;

FIG. **5** is a diagrammatic view illustrating a format of each block in FIG. **4**;

FIG. **6** is a diagrammatic view illustrating a format of a second mapping region in FIG. **4**;

FIG. **7** is a flowchart illustrating a method of recording the optical information in accordance with the present invention; and

FIG. **8** is a flowchart illustrating a method of reproducing the optical information in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. **3**, there is shown a block diagram of an apparatus for recording/reproducing optical information in accordance with the present invention. As shown in this drawing, the recording/reproducing apparatus of the present invention comprises a host central processing unit (CPU) **1** as a main processor for controlling the entire operation of the system, a system interface/system CPU **2** for transferring a plurality of control signals from the main processor **1** to the associated components and controlling the associated components under the control of the main processor **1**, and a RAM **3** for storing data from the system interface/system CPU **2**.

An error detection/correction circuit **4** is provided in the recording/reproducing apparatus to detect an error of the data stored in the RAM **3** and correct the detected error.

A sector read/write control circuit **5** is also provided the recording/reproducing apparatus to read and write a target sector address of the error detected by the error detection/correction circuit **4**.

A disk controller **6** is also provided in the recording/reproducing apparatus to control an optical disk **12** in response to the target sector address read from the sector read/write control circuit **5**.

The recording/reproducing apparatus also comprises a mapping memory **7** for storing mapping sector information from the system interface/system CPU **2**, a modulating/demodulating circuit **8** for modulating the data from the RAM **3** and writing demodulated data into the RAM **3**, a control logic circuit **9** for outputting a control signal in response to an output of the modulating/demodulating circuit **8**, a drive control circuit **11** for driving the optical disk **12** in response to the control signal from the control logic circuit **9**, and a drive interface **10** for transferring the control signal from the control logic circuit **9** to the drive control circuit **11**.

The operation of the recording/reproducing apparatus with the above-mentioned construction in accordance with the present invention will hereinafter be described in detail.

First, for the purpose of efficiently managing and handling bad sectors in recording or reproducing data on/from the optical disk, tracks of the optical disk as shown in FIG. **2** constitutes blocks in the unit of a predetermined number (for example, 100 tracks/1 block) as shown in FIG. **4**. In FIG. **5**, the tracks are numbered beginning with 1, whereas 0 in FIG. **4**.

In FIG. **4**, each block (100 tracks) is provided with a user data track region **13** including 99 tracks (No. 0–98) and a first mapping region **14** including the remaining one track (No. 99). A second mapping region **15** is further provided on a center one of the entire tracks. Namely, if the total number of the tracks is, for example, 10,000, the second mapping region **15** is provided on the track numbered with 5,000. The second mapping region **15** includes a mapping information recording region and a replacement sector region for the 100 first mapping regions **14** of the whole of the blocks. In this connection, the second mapping region **15** is used for the management and replacement of the bad sectors of the entire tracks.

As shown in FIG. **5**, each of the first mapping regions **14** includes three mapping sectors M1–M3 provided at the head of the last track of each of the blocks and the subsequent replacement sectors R1–Rn provided on the same track. In FIG. **6**, the replacement sector region of the second mapping region **15** is used when the replacement sectors R1–Rn of each of the first mapping regions **14** are insufficient or when a defect is present on the mapping information recording region of the second mapping region **15**. It should be noted that, the number of tracks per block may be such a value that an optical head can scan at a high speed or a value within the optimal operable range of the optical head.

The blocks #1–#N are formatted on the optical disk in the above manner before data is accessed by a drive system. Test data is recorded on the formatted blocks #1–#N. The test data is then reproduced from the blocks #1–#N. In this manner, it is discriminated whether an error is present in the sector address or a defect is present in the data region. If it is discriminated that the error is present in the sector address, the same mapping information on the corresponding bad sector is recorded on the mapping sectors M1–M3 of the first mapping region **14** of the corresponding block as shown in FIG. **5**. Also, the replacement sectors R1–Rn of the first mapping region **14** are used when the mapping sectors M1–M3 of the same first mapping region **14** are bad sectors.

For example, provided that the mapping sector M1 of the first mapping region **14** is bad, the information on the mapping sector M2 thereof is read by the drive system. Similarly, if the mapping sector M2 of the first mapping region **14** is bad, the information on the mapping sector M3 thereof is read by the drive system. Also, as shown in FIG. **6**, the second mapping region **15** is provided on the center one (No. **4999**) of the entire tracks and includes the mapping information recording region and the replacement sector region for the 100 first mapping regions **14** of the whole of the blocks. All information regarding the first and second mapping regions **14** and **15** are stored in the mapping memory **7**. Therefore, actual data is recorded on the optical disk **12** after confirmation of presence of a defect on the corresponding recording region depending on the information in the mapping memory **7**. On the other hand, provided that the mapping sector SM1 of the second mapping region **15** is bad, the information on the mapping sector SM2 thereof is read by the drive system. Similarly, if the mapping sector SM2 of the second mapping region **15** is bad, the information on the mapping sector SM3 thereof is read by the drive system.

As mentioned above, the blocks #1–#N are formatted on the optical disk **12** at an interval of 100 tracks. Under this condition, the optical information recording/reproducing apparatus discriminates the presence of the errors in the sector address and data and the defect on the recording region by recording and reproducing the test data on/from the sectors of the blocks. In accordance with the discriminated result, the recording/reproducing apparatus records the information on the bad sectors on the mapping sectors M1–M3 of the first mapping region **14**.

The sector address error signifies a self-error in the sector on which the data is to be recorded. The sector error address is read or written as the target sector address by the sector read/write control circuit **5**. The control logic circuit **9** detects the sector error address in response to the output signal from the sector read/write control circuit **5**.

The data error in the data region is detected as an error detection/correction code by the error detection/correction circuit **4**. Recorded on the mapping sectors are addresses of the bad sectors and addresses of the replacement sectors for the bad sectors. Also, states of the replacement sectors are recorded on the mapping sectors.

Referring to FIG. **7**, there is shown a flowchart illustrating a method of recording the optical information in accordance with the present invention. First, the main processor **1** generates a recording command to the system interface/system CPU **2** at the step A1. In response to the recording command from the main processor **1**, the system interface/system CPU **2** outputs a device command block to the disk controller **6**. Upon receiving the device command block, the disk controller **6** instructs the drive control circuit **11** to scan a track of a block to which the target sector belongs. It is checked

at the step A2 whether the target track/sector (referred to hereinafter as the target sector) is a bad sector. Information is stored in the RAM 3 in accordance with the checked result.

If the target sector has been scanned, the system CPU 2 reads the information from the mapping sector M1 and stores the read information into the mapping memory 7 at the step A3. At this time, the system CPU 2 reads the information from the mapping sector M2 if the mapping sector M1 is bad and, going one step forward, reads the information from the mapping sector M3 if the mapping sector M2 is bad, and then stores the read information into the mapping memory 7.

The system CPU 2 receives data to be recorded on the optical disk from the main processor 1 and stores the received data into the RAM 3 at the step A4. The error detection/correction circuit 4 checks at the step A5 whether correct data from the main processor 1 is sent to the RAM 3. Here, the error detection/correction circuit 4 does not perform the function of detecting and correcting the error of the data, but checks using a parity bit whether correct data from the main processor 1 is sent to the RAM 3.

Then, it is checked at the step A8 whether the target sector is the bad sector. If it is checked at the step A8 that the target sector is the bad sector, a replacement sector address is detected from the mapping information in the mapping memory 7 to allot the corresponding replacement sector to the target sector at the step AT. The allotted replacement sector is changed into the target sector. The information regarding the bad sector and the replacement sector is updated and the updated information is stored in the RAM 7.

In the case where all of the replacement sectors of the corresponding block have been used, one of the sectors of the replacement sector region not used is allotted to the replacement sector. The information regarding the mapping sectors M1–M3 in the mapping memory 7 is updated on the basis of the allotted replacement sector.

If it is checked at tile step A6 that the target sector is normal or after performing the step A7, the disk controller 6 instructs the drive control circuit 11 to seek the track of the block to which the target sector belongs, at the step A8. Also, the disk controller 6 sets the recording command in the sector read/write control circuit 5 so that the data can be recorded on the target sector.

The modulating/demodulating circuit 8 modulates the data from the RAM 8 and outputs the modulated data to the drive control circuit 11 so that the data can be recorded on the target sector of the optical disk 12 at the step A9.

Referring to FIG. 8, there is shown a flowchart illustrating a method of reproducing the optical information in accordance with the present invention. First, the main processor 1 generates a reproduction (read) command to the system interface/system CPU 2 at the step B1. In response to the reproduction command from the main processor 1, the system interface/system CPU 2 outputs a device command block to the disk controller 6. Upon receiving the device command block, the disk controller 6 instructs the drive control circuit to scan the first mapping region 14 of a block to which the target sector from which the data is to be read belongs. It is checked at the step B2 whether the target sector is a bad sector. Information is stored in the RAM 3 in accordance with the checked result.

If the target sector has been scanned, the system CPU 2 reads the information from the mapping sector M1 and stores the read information into the mapping memory 7 at the step B3. At this time, the system CPU 2 reads the information from the mapping sector M2 if the mapping sector M1 is bad and, going one step forward, reads the information from the mapping sector M3 if the mapping sector M2 is bad, and then stores the read information into the mapping memory 7. Also, if the first mapping region 14 is bad or the replacement sector to be used is not present in the first mapping region 14, the system CPU 2 scans the second mapping region 15.

It is checked at the step B4 whether the target sector is the bad sector. If it is checked at the step B4 that the target sector is the bad sector, a replacement sector address is detected from the mapping information in the mapping memory 7 to read a replacement sector of the corresponding block at the step B8.

If it is checked at the step B4 that the target sector is normal, the disk controller 6 instructs the drive control circuit 11 to seek the track of the block to which the target sector belongs, at the step B6. Also, the disk controller 6 sets the read command in the sector read/write control circuit 5 so that the data can be read from the target sector. An optical head (not shown) is moved to the target sector at the step B7.

After performing the step B7, the data read by the optical head is applied to the modulating/demodulating circuit 8 through the drive control circuit 11 and the control logic circuit 9. The modulating/demodulating circuit 8 demodulates the data from the optical head and outputs the demodulated data to the RAM 3 at the step B8.

The error detection/correction circuit 4 detects the error of the data stored in the RAM 3 and corrects the detected error at the step B9. The error to be corrected is a random error or a burst error which may take place on the disk or due to any other causes when the data is read from the disk.

The error-corrected data from the error detection/correction circuit 4 is again stored in the RAM 3. The error-corrected data from the RAM 3 is sent to the main processor 1 through the system interface/system CPU 2 at the step B10. In this manner, the reproduction of the data recorded on the optical disk 12 is performed.

As apparent from the above description, according to the present invention, the bad sectors can efficiently be handled although they are generated in large quantities or in use of the optical disk. Therefore, the data, can reliably be recorded or reproduced and the manufacturing cost can be reduced.

Although the preferred embodiments of the present invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

What is claimed is:

1. A method of recording optical information using an optical disk, comprising the steps of:

checking whether a target sector of the optical disk on which data is to be recorded is a bad sector, upon receiving a data recording command from main processing means;

storing information into storage means in accordance with the checked result;

reading information from mapping sectors of a block of the optical disk to which said target sector belongs and storing the read information into mapping memory means;

receiving the data to be recorded from said main processing means and checking for an error in the received data;

checking whether said target sector is the bad sector;

allotting a replacement sector located in a center of the optical disk to the target sector if it is detected that said target sector is the bad sector, and updating the mapping sector information in said mapping memory means;

seeking said target sector if it is checked that said target sector is normal and setting the recording command in sector read/write control means so that the data can be recorded on said target sector; and

modulating the data and recording the modulated data on said target sector.

2. A method of reproducing optical information using an optical disk, comprising the steps of:

checking whether a target sector of the optical disk from which data is to be reproduced is a bad sector, upon receiving a data reproduction command from a main processing means;

storing information into storage means in accordance with the checked result;

reading information from mapping sectors of a block of the optical disk to which said target sector belongs and storing the read information into mapping memory means;

checking whether said target sector is the bad sector;

reading a replacement sector in a center block of the optical disk if it is detected that the target sector is the bad sector, and updating the mapping sector information in said mapping memory means:

seeking said target sector if it is checked that said target sector is normal and setting the reproduction command in a sector read/write control means so that the data can be reproduced from said target sector;

moving an optical head to said target sector;

demodulating the data read by said optical head;

correcting an error of the demodulated data and storing the error-corrected data into said storage means; and

sending the error-corrected data stored in said storage means to said main processing means through system processing means.

3. A method of recording optical information using an optical disk, comprising the steps of:

providing an optical disk-shaped recording medium having on a surface thereof a plurality of tracks, wherein a predetermined number of said tracks constitute blocks, each of the blocks including:

a data region,

a first mapping region, each of which includes:

mapping sectors, each of which includes an area for recording mapping information about bad sectors of the corresponding block thereon, and

replacement sectors, wherein the replacement sectors of each of the first mapping regions are replaced for bad sectors of the corresponding block,

a second mapping region located at a center one of all the tracks, which includes:

a mapping information recording region and

a replacement sector region for the first mapping regions of the entirety of the blocks,

receiving a data recording command from main processing means and determining whether a target sector on which data is to be recorded is a bad sector, responsive to the data recording command;

storing information into storage means in accordance with the bad sector determination;

reading information from the mapping sectors to which the target sector belongs and storing the read information into mapping memory means;

receiving from said main processing means data to be recorded and checking for an error in the received data;

determining whether the target sector is a bad sector;

allotting a replacement sector located in a center of the optical disk to the target sector if it is determined that it is a bad sector and updating the mapping sector information in the mapping memory means;

seeking the target sector if it is determined that it is not a bad sector and setting the recording command in a sector read/write control means so that the received data can be recorded on the target sector; and

modulating the received data and recording the modulated data on the target sector.

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